AUTOMOTIVE INDUSTRIES

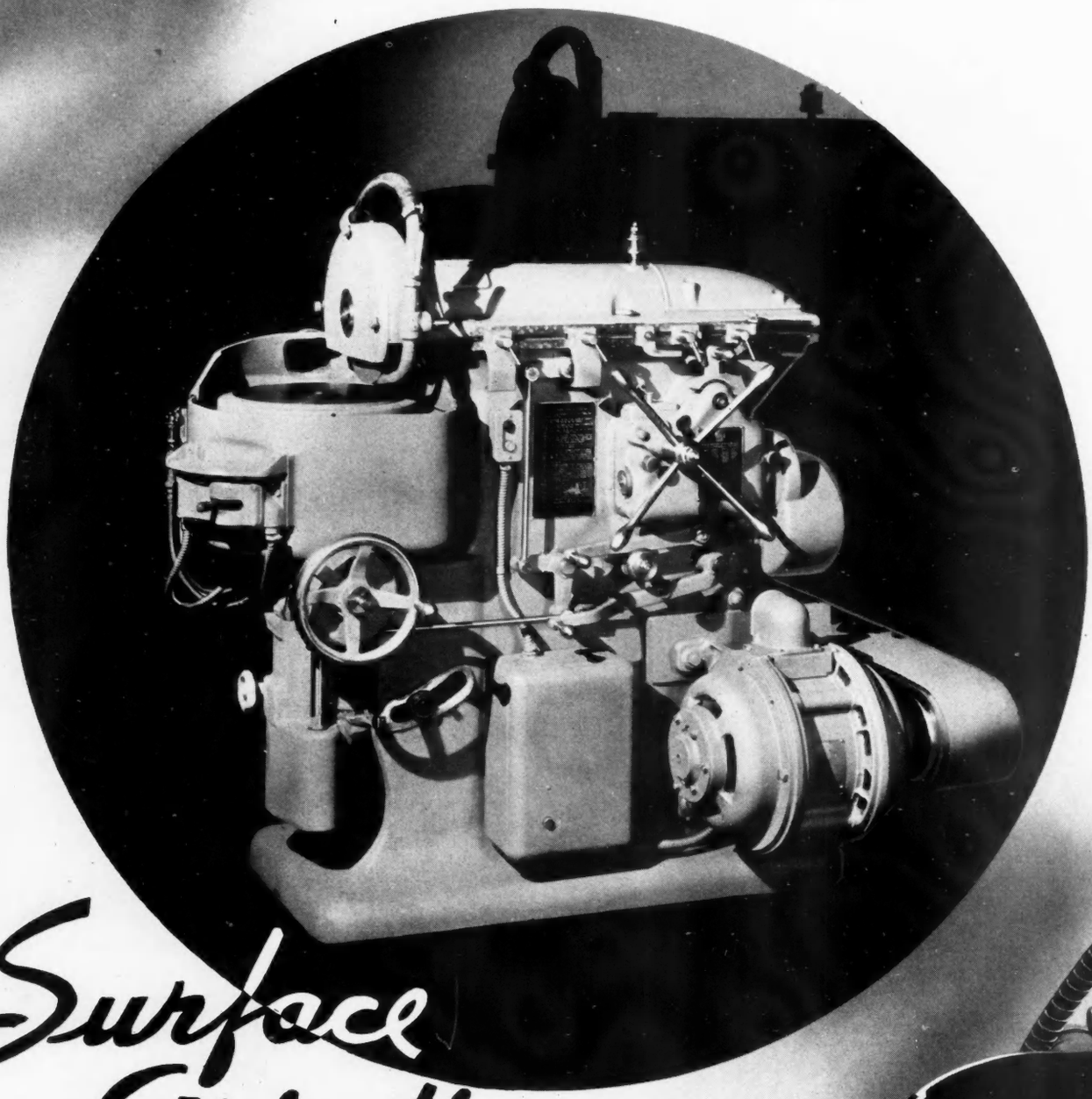
LAND — AIR — WATER

MAY 16 1941

MAY 15, 1941

A "MERRY-GO-ROUND" WITHOUT MUSIC

Science Adapts Carnival Machine Idea To Test Bearing Seals



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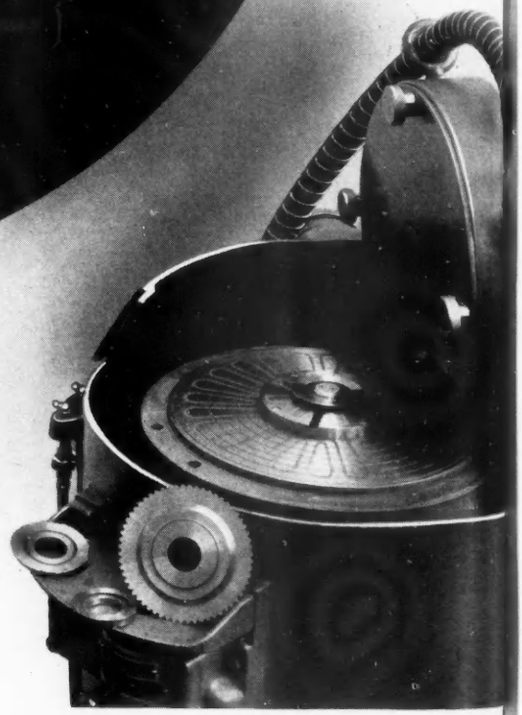

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 84 Number 10

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Cable Address..... .Autoland. Philadelphia

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903, the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY
(Incorporated)

Executive Offices
Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

AUTOMOTIVE INDUSTRIES. Vol. 84, No. 10. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. Entered as Second-Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In Case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $1.00 per year. Canadian and Foreign, $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 1, 1941), 50 cents.

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AVIATION INDUSTRIES

Army's Air Freight Service 509

The U. S. Army is operating a freight service that practically blankets the nation. The routes and how they are operated is told in this article.

Aircraft Structures Laminated with Plastics 512

A new technique in the construction of aircraft is gradually creeping into manufacturing procedure at several airplane plants. This article by Herbert Chase is a follow-up of one that appeared recently and brings you right up to the minute in this new method.

Flush Riveting in Aircraft 518

Flush riveting has long been a subject of more than passing interest. Recently the Douglas Aircraft Co. obtained a patent on a method of flush riveting. This fills a big gap in the construction methods and for the purposes of the defense program has been made available to the industry at large. Here the story is told in full.

The Messerschmitt 110 530

So much has been guessed about this German plane that it should prove most enlightening to read this descriptive article of its construction. The text and illustrations clear up many questions that might have been in your mind.

Lead Base Alloy Die Castings 520

Lead base alloys have many advantages in die casting. What is being done in this field and how the best results are being obtained is the subject matter that is most fully explained in this article.

De Havilland Method of Making Propeller Blades

A British patent on a method of manufacturing propellers of laminated phenolic materials for airplanes has been issued to De Havilland Aircraft Co., Ltd. The construction is described as of the "stressed-skin" type, and the blades are shaped mainly by molding.

A pack of boards, consisting of six long ones, six intermediate, and six short ones, are interleaved with the corresponding pack for another blade, so that a rectangular block is formed. The boards are of wood impregnated with unset phenol-formaldehyde resin. Along the contacting surfaces of the interleaved boards where adhesion is to be avoided, metal foil is placed. Next the whole pack is placed in a press and heated; it is then pressed until there is complete adhesion between all of the boards in contact and the resin is partially set and homogenized, though not completely. The two structures, easily separable because of the interspersed foil, are now removed from the press and separated.

Each structure now consists of a solid root and "fingers" of a thickness which is stepped down away from the boss. It is next cut to its required shape, and then a "skin" of wire gauze is tacked (with its mesh diagonal) to the edges of the fingers and shaped to the required profile of the blade. The gauze-covered reinforcement is now placed in a mold, which is the shape of the finished blade. Within the hollow spaces are placed rubber and reagents for the formation and vulcanizing of expanded rubber. The mold is then closed, and heat applied so that the rubber is formed and set throughout the whole available space, in the cellular structure of hard expanded rubber. The wire gauze is just covered with rubber, the pattern of the gauze being discernible to leave a good keying surface for a finishing coating. The temperature at which the rubber expansion and vulcanization takes place is such as to complete the polymerization of the resin, and the pressure within the mold, generated by gasifying of the rubber, helps to consolidate the resin. After setting and cooling, the mold is opened and the blade removed for the finishing operations.

AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

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May 15, 1941

Army's Air Freight Service

Official photograph, U. S. Army Air Corps

A radial engine goes aboard a Douglas transport for shipment to overhauling station.

By L. W. MOFFETT

WITH THREE groups assigned and three additional groups attached to it, the Army's fast cross-country air freight service, organized in July, 1935, now is operating approximately 40 powerful, specially designed Douglas C33 and C39 twin-engined transport cargo planes out of and between four main continental air depots. These depots are located at Olmstead field, Middletown, Pa., the easternmost point; Patterson field, Fairfield, Ohio; Duncan field, San Antonio, Tex.; and McClellan field, Sacramento, Calif., the westernmost point. Los Angeles is on the present routes and, in late summer or fall of this year, depots at Ogden, Utah, and Mobile, Ala., will be added to the service.

New engines, propellers and Government-furnished equipment compose the bulk of inter-depot shipments. About 30 per cent of the cargoes are intra-depot shipments, which include distribution of supplies and overhauled engines. Return shipments bring back repairable assemblies from outlying stations to the repair depots.

The service was expanded in 1938 to include inter-depot flights and, subsequently, coast-to-coast flights. This resulted primarily from the urgency of keeping an even flow of Government-furnished equipment from manufacturers in the East to aircraft factories on the West Coast. By air, this movement normally requires two to two and one-half days. Water shipment by Army transport through the Panama Canal sometimes took as long as six months due to the shortage of transports.

Since air shipment is something over four times faster than rail and truck service, a secondary value results from its speed, as, for instance, the stock of spares in any given control area frequently can be

reduced, because the air transport can deliver from the base point with little or no delay.

Already ranking, from a point of mileage, as the sixth airline of the United States the service is known as the Army Air Corps Fiftieth Transport Wing, Field Service Section of the Materiel Division, and it is planned rapidly to expand its operations. Approximately 1,000,000 lb. is moved an average distance of 400,000 miles each month by air, the average load being about 2000 lb. There are also approximately 500 passengers transported monthly in connection with movements of airplanes and other Government business. These planes are also used for the training of parachute troops.

Covering 16,398 flying hours, and 1,928,000 miles the transport planes carried 3,395,000 lb. of cargo and more than 2000 passengers including ferry pilots and inspectors in the first half of last year.

While the planes used are similar to certain commercial types, they have wider side loading doors and reinforced floors. In shipping assembled propellers, they are secured to the under side of the fuselage as shown in one of the accompanying photographs. The reduction of speed because of this method of carrying them is said to be only about 10 miles an hour.

Weekly trips are made from Fairfield to San Antonio, to Sacramento, to Los Angeles, to Fairfield; from Sacramento to Los Angeles, to San Antonio, to Fairfield, to Sacramento; and to provide a direct two-way service connecting San Antonio, Fairfield and Middletown. The transport corps also operates weekly to the Panama Canal from San Antonio to carry urgently needed supplies.

A typical flight schedule is routed from Middletown to Fairfield, to Sacramento, to Los Angeles, and return to the base station. Loaded with 3200 lb. of Government-furnished equipment and materials for other depots, the departure of a plane is radioed to Group Operations at Wright Field, Dayton, Ohio, stating freight load, crew, aircraft number and departure time. This is spotted on the routing board and follows the transport through the entire flight. A radiogram is received which states that 500 lb. of higher priority material is at Patterson Field

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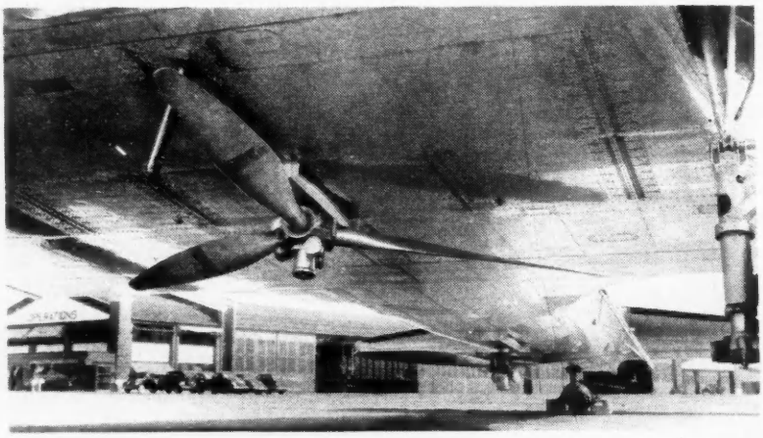
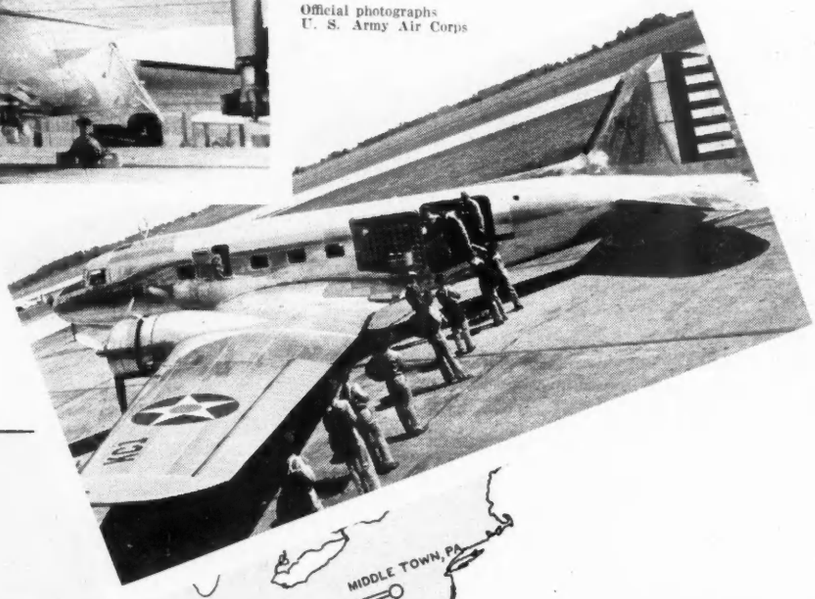
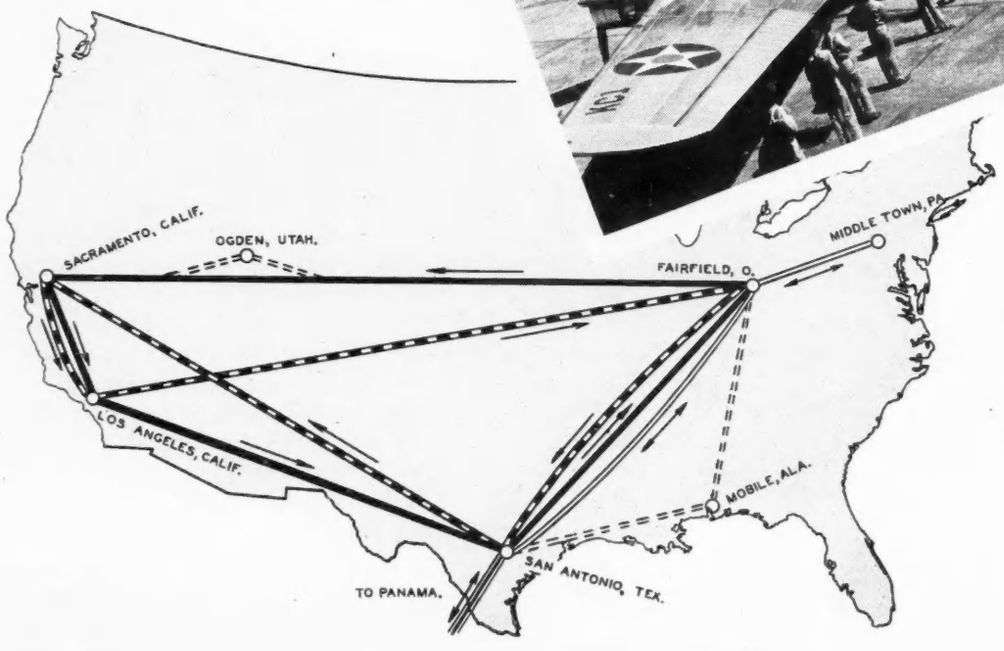


Official photographs
U. S. Army Air Corps



Assembled propellers are shipped fastened to the underside of the transport's fuselage.



At one of the Army air freight depots, a transport takes on its cargo. A nominal load is 3200 pounds. The map shows the regular routes now flown and the depots at Ogden and Mobile that will be added to the service later this year.

Wright Field Wind Tunnel

WHEN the new wind tunnel is completed this summer at Wright Field, Dayton, the U. S. Army Air Corps will have one of the most modern aerodynamical laboratories for making tests with scale models of warplanes and their component parts. But before this $2,500,000 wind tunnel can be used for actual testing, many weeks of calibration work will be necessary.

Air speeds as high as 400 m.p.h. will be possible in the test chamber of 20-ft. diameter. Scale models with spans up to 15 ft., and full-size fuselages, engine-nacelle-propeller combinations or airfoils will be tested there in wind streams that will simulate actual flying conditions. The larger of the two existing Wright Field tunnels can accommodate models with wing spreads no greater than 4 ft. and at air speeds no higher than 100 m.p.h. Ability to increase both the model size and air stream velocities to the new limits will enable Air Corps engineers to obtain more accurate performance information for both military and commercial application.

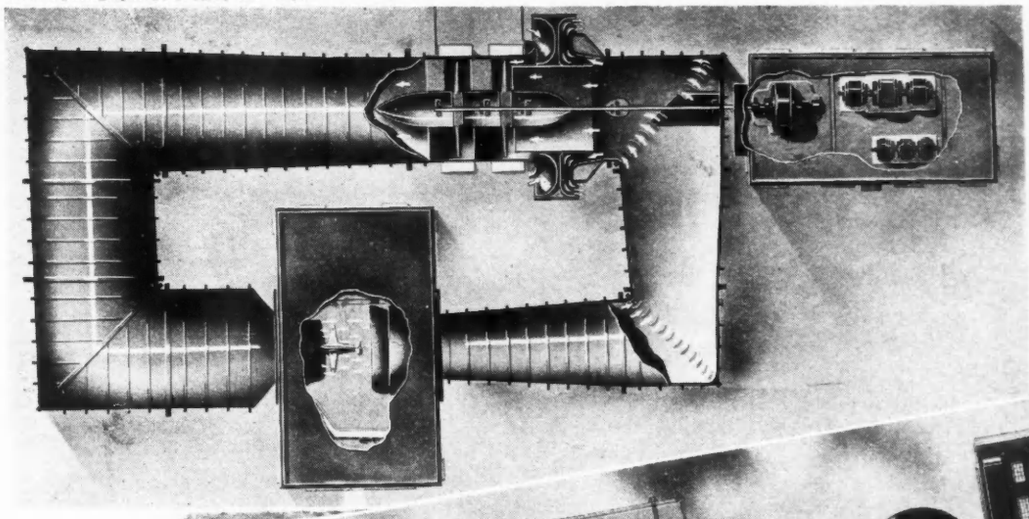
To drive the air blast through the test chamber at a 400-mile-an-hour clip requires a 40,000 hp. motor, which was finished recently by the Westinghouse Electric & Mfg. Co. It is the world's largest induction motor, weighs 125 tons, is 15 ft. in diameter and has a 10-ft. diameter, 50-ton rotor whose speed can be varied from 37 to 297 r.p.m. When operating at top speed, it consumes over 30,000 kilowatts of electricity, more than is normally required for a city of 200,000 population. Over 85,000 cu. ft. of air will have to be forced through it every minute to keep the rotor cool.

In the power building is housed 132,000 hp. in rotating equipment, including the giant motor and two motor-generator sets. The most unusual feature of the drive system is the method of speed control. Ordinarily, about 6000 hp. would be wasted at low speeds if rheostats and a series of resistances were used to regulate the speed, but by using a system of two motor-generator sets, the secondary (variable frequency) energy is partially recovered by taking it from the rotor of the big motor and recirculating it through the motor-generator sets to the power line—to help drive the motor.

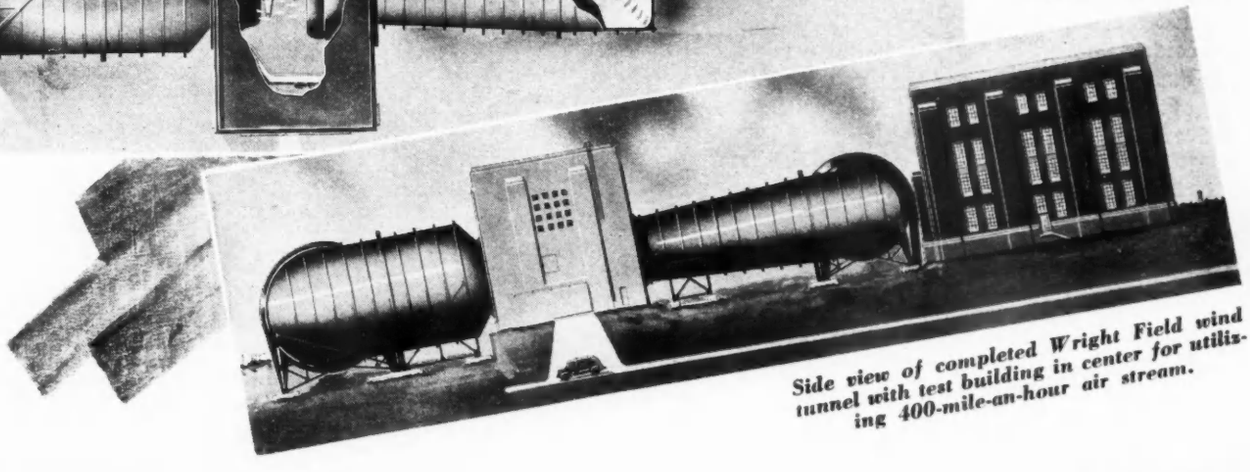
The turning force is transmitted to two 40-ft. fans in tandem through a 16-in. steel shaft 120 ft. in length. Each of these big fans has 16 blades with a combined weight of 12 tons and at top speed, a retaining force of over 200 tons per blade is required to keep it from tearing away from the hub. These giant fans must exert a pulling force of 60 to 70 tons to circulate the air through the tunnel at maximum velocity. Since heat will be generated rapidly in this high speed

(*Turn to page* 555, *please*)

Official photographs U. S. Army Air Corps.



(Left) Arrows indicate the counter-clockwise course of the air stream through the tunnel circuit, which measures 616 ft. Cutaways show test chamber, fan section and air exchanger, and the power equipment.

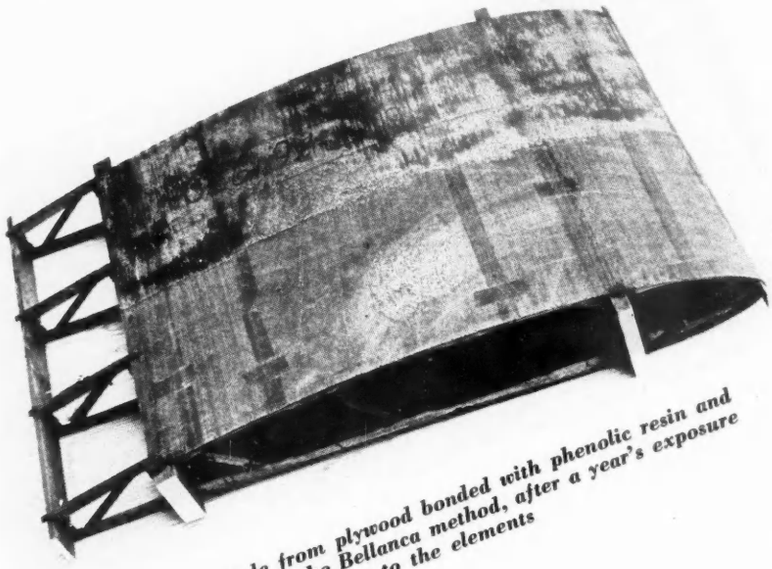


Side view of completed Wright Field wind tunnel with test building in center for utilizing 400-mile-an-hour air stream.

Aircraft Structures

By Herbert Chase

As pointed out in a prior article, several methods are now being used in fabricating major aircraft structures by the use of plastics as adhesives when the structure, built up from wood veneers, is molded to shape. These structural parts are not properly referred to as "plastic" parts. They are basically wooden structures, but plastics perform a highly important function in "welding" them, as it were, into units which, according to such information as is available, are substantially unaffected by moisture, weathering and other conditions met in service. This, in effect constitutes the primary and most important difference between the plastic-bonded structure and one bonded by casein or other glues heretofore used and largely abandoned because they were not dependable.



Wing made from plywood bonded with phenolic resin and fabricated by the Bellanca method, after a year's exposure to the elements

Having described the fabricating processes, it remains to point out the advantages gained by the processes, especially as compared with structures fabricated from metal, and to cite certain performance tests which appear to have established the feasibility of the types of structures under consideration.

Plastic-bonded plywood structures possess, according to the evidence now available, the following advantages:

1—Light weight.

2—Moderately high strength-weight ratios.

3—Rapidity and simplicity of fabrication.

4—Adaptability to widely varying shapes.

5—Ability to resist deterioration through moisture absorption, weathering, rapid changes in temperature, attack by micro-organisms (fungii) and insects.

6—Ability to resist distortion better, in some respects, than metal structures of equal weight and, in some cases, of greater weight.

7—Unusual smoothness of contour and freedom from the increased drag resulting from small projections such as rivet heads.

8—High, though not complete, resistance to fire.

9—Resistance to corrosion and to solvents, such as fuels and lubricants.

10—Low heat conductivity, with consequent reduced tendency to icing.

11—A degree of non-resonance superior to most metals, with consequent ability to "absorb" vibration.

Doubtless there are other minor advantages, but those listed include the major ones and constitute ample reason for the unusual interest and extensive development work now in progress with a view to realizing these advantages in thoroughly practical structures. It is not contended, of course, that plastic-bonded plywood structures will completely displace metal structures in any plane or that, as far as can be seen now, they will displace the major structures in planes of the large size in which all-metal construction has proved its worth. Developments of the near

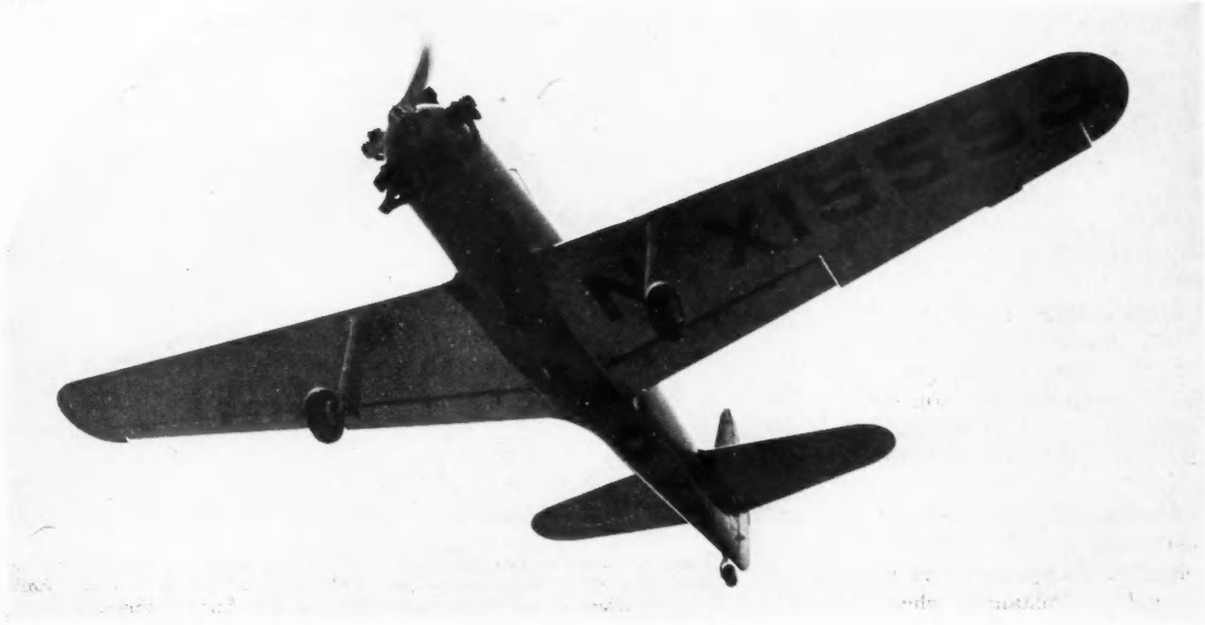
Laminated with Plastics

future are likely to be in training and small commercial and private planes, or primarily there, with the probability that they will be extended into larger craft when their merits in the smaller type have been established over longer periods. There would seem to be no reason, however, why excellent combinations of metal structures with plastic-bonded plywood cannot be worked out, each being used where its greater merits for the particular purpose dictates, and each supplementing the other.

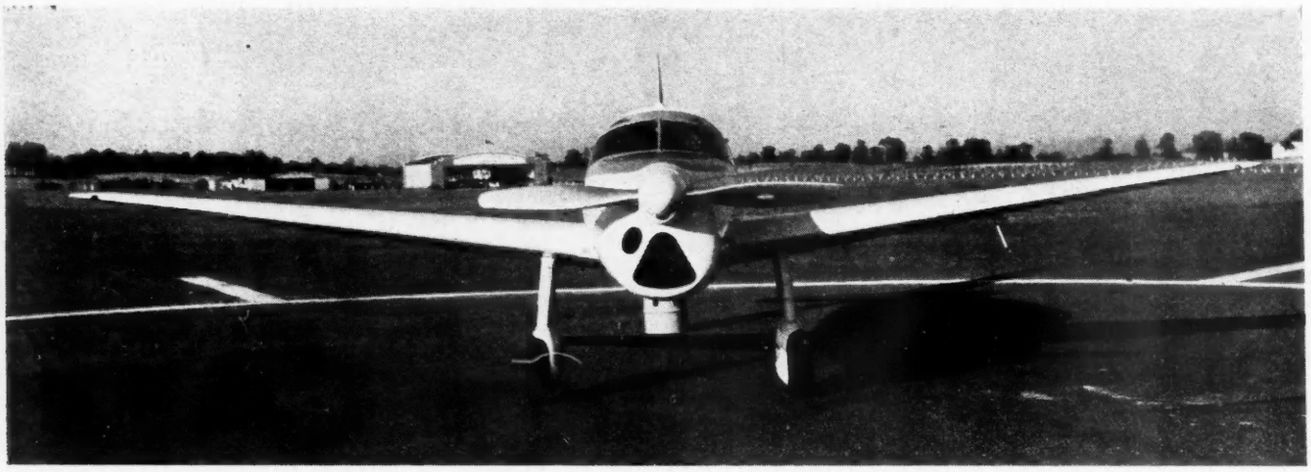
In his paper before the S.A.E. in May, 1939, Col. V. E. Clark stated that the specific gravity of Duramold (built up from plies of wood bonded with phenolic resin) can be accurately controlled within 3 per cent, plus or minus, between the limits of 0.5 and 0.9 and that the strength and elastic modulus vary, roughly, as the density. This compares with a specific gravity of 2.8 for Duralumin. He pointed out that deflection in buckling under compressive load varies inversely as the elastic modulus of the material and inversely as the *cube* of the thickness. For a given weight of thin plate, Duralumin, says Clark, has 7.65 times the buckling stiffness of a steel plate of the same weight (specific gravity 7.85). The superiority of the Duralumin is attributable, however, to its low density which, in turn, makes the plate, for a given weight, about three times as thick as the steel plate. It is thickness which is so highly important. But even the thicker plates of Duralumin used in parts forming "skin" require much internal stiffening and still they are subject to distortion in flight. A skin of Duramold, however, can be at least three times as thick as one of Duralumin and still not exceed the weight of the latter. Moreover, because of its thickness and the consequent greater stiffness, less reinforcement is required.

It is partly for this reason that Duramold and other similar plywood structures laminated with plastics offer great possibilities. Clark gives figures indicating that a smooth-skin 17ST aluminum alloy cylinder of 60-in. diameter having 0.032-in. skin thickness, will support, with a particular type of stiffening structure, 63,000 lb., whereas a Duramold cylinder, of the *same weight per foot*, will support 80 per cent more load.

The tensile strength of plastic-bonded plywood varies, of course, with the type of wood used, the thickness of plies, and the proportion and character of plastic employed. For birch, bonded with phenolic resin, figures varying. from about 20,000 to about 32,000 psi in tension and 22,000 to nearly 25,000 psi in compression have been secured, according to some published data, but such figures are not of much significance unless the various conditions applying are



Timm plane with fuselage, wings and tail surfaces molded from plywood bonded with phenolic resin



This Fairchild plane has a fuselage molded from plywood bonded with phenolic resin by the earlier Duramold process, and the wing coverings are plastic-bonded plywood sheet

known. It is significant, however, that the addition of plastic renders the composite product almost as strong in compression as in tension, whereas wood alone is much weaker in compression than in tension. Important also is the high strength-weight ratio, as well as the fact that the low specific gravity makes it feasible to use relatively thick sections without excessive weight.

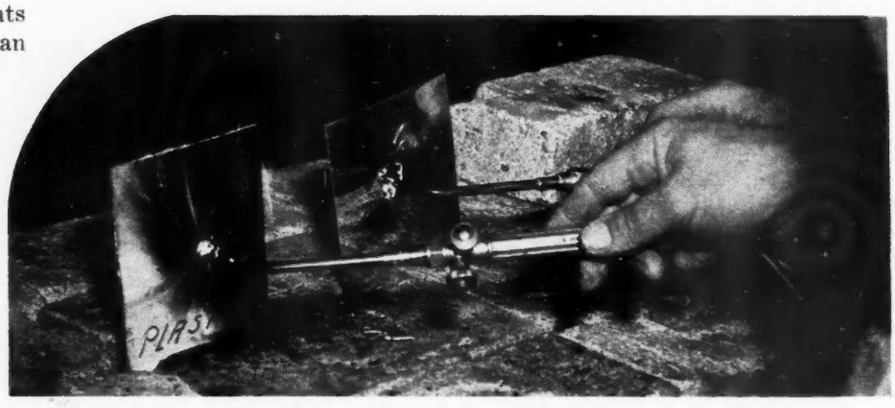
In respect to rapidity and simplicity of construction, the author has not succeeded in securing specific data. It appears to be possible, however, to construct within a few hours, or a day at most, a substantially complete structure such as a fuselage or wing, and to cure a considerable number of such parts, perhaps all the major structural parts of a complete plane, simultaneously in a time varying from an hour or less up to a day of eight hours, depending on the specific method and section thicknesses involved.

It is conceivable that, with an ideal setup, equal speed might be attained in all-metal construction, but certainly not without a vastly greater number of operations and a far larger number of man-hours of labor, if the conventional practice of assembly by riveting is followed. One estimate gives 320,000 as the number of rivets in one two-engine Navy seaplane, and the cost of supplying and driving these is 5 cents each and upward, or not less than $16,000 per plane. No rivets are used in fabricating plywood structures with plastics, and indications point to a large saving on this score alone, though how great it would be one can only guess until comparative figures based on actual production in comparable cases are available.

Savings in time and in cost are important in themselves, of course, but, under present circumstances, when most metal working facilities are taxed to their limit and are likely to be for some time to come, and when skilled mechanics are exceedingly scarce, any shift to woodworking which nets a similar product should be welcomed. The technique of producing such laminated structures is quite simple and, according to some reports, can be quickly and easily acquired at the same time the necessary labor is drawn from a different group than that needed for metal working. Although metal molds are employed in some cases, they are light ones made from sheet metal and are relatively low in cost, and wooden molds are said to have been used, at least for experimental purposes. A relatively nominal figure of $5,000 for a set of molds for all the major plywood units for a complete plane is given by one producer of such parts, but many sets of such molds doubtless would be needed for a large production program.

That the molding of laminated structures with plastic binders can be done on widely varying shapes is apparent from illustrations in this and the prior article. Limitations in this regard are less rigid in some

(*Turn to page* 552, *please*)



Demonstration by the Timm Aircraft Corporation, of the fire-resisting properties of aircraft materials. The plywood panel is only charred whereas the aluminum alloy panel is burned through

Progress and Prospects in Aircraft Production

A LARGE number of interesting facts relating to accomplishments to date in airplane production in the United States and outlining plans for and possibilities of increased production during the coming months, were presented in an address by Colonel John H. Jouett, President of the Aeronautical Chamber of Commerce of America, delivered at the recent meeting of the United States Chamber of Commerce.

The main points brought out by Colonel Jouett in that part of his address which dealt with the production of military airplanes are here given in more or less telegraphic form.

Aircraft manufacturers to date have been asked to build about 44,000 military airplanes of which 16,500 are for the Army, 8500 for the Navy, and 16,000 for the British, including Canada, and 3600 bombers to be built under the Knudsen plan.

The great bulk of these orders have been placed since the autumn of 1940, and already nearly 7000 planes have been delivered. In the 20 months since the outbreak of the war nearly 3500 military planes have been exported to the British and are now being used on all fighting fronts throughout the world. In 1939, aviation manufacturers did $225,000,000 worth of business; in 1940, $544,000,000 and this year they are expected to turn out $1,500,000,000 worth of airplanes.

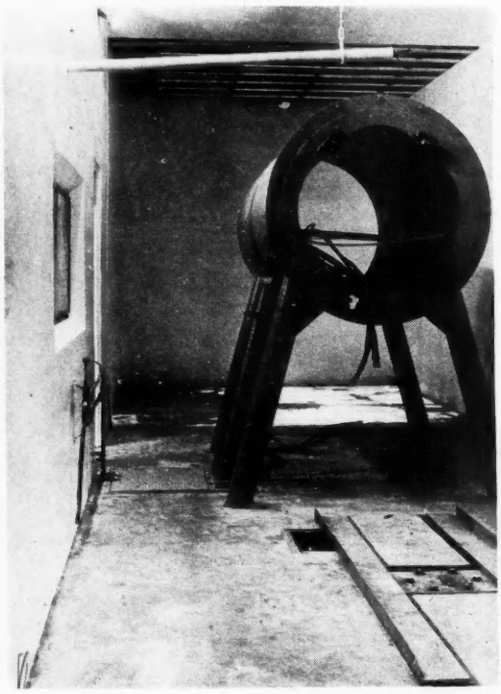
Meanwhile, plant expansion has increased floor space from 17,216,410 sq. ft. on July 1, 1940 to 31,383,967 sq. ft. as of March 1, 1941, an increase of 82 per cent. During this same period, 106,066 new employees were taken on by aircraft manufacturers and trained in the art of airplane building. This 88 per cent increase in employment brought the present man power up to 226,172 as of March 1 of this year.

The production curve is steadily rising from 700 planes in November, 800 in December, 1000 in January to 1200 during March. Further increase will come, and at a higher rate, when new plant facilities are in operation and additional material is made available. Plants are working 24 hours a day, six days a week, the seventh day being utilized for vital maintenance of machinery and plant clean-up.

The March production of 1200 planes should be doubled by the summer of 1942. This year alone, it is estimated, 18,000 planes will be turned out and, under the present program, 30,000 will be turned out during 1942. Even now, half our output coupled with British output exceeds Axis plane production.

Precision is the paramount consideration in the building of aircraft engines and airplanes. 50,000 separate inspections are conducted on an aircraft engine; 30,000 man hours of labor go into a medium bomber; 450,000 rivets are used for a heavy bomber. In one medium bomber, 30,000 parts exclusive of nuts, bolts and rivets are worked into 650 minor sub-assemblies and these in turn into 32 major sub-assemblies before they are put into a plane.

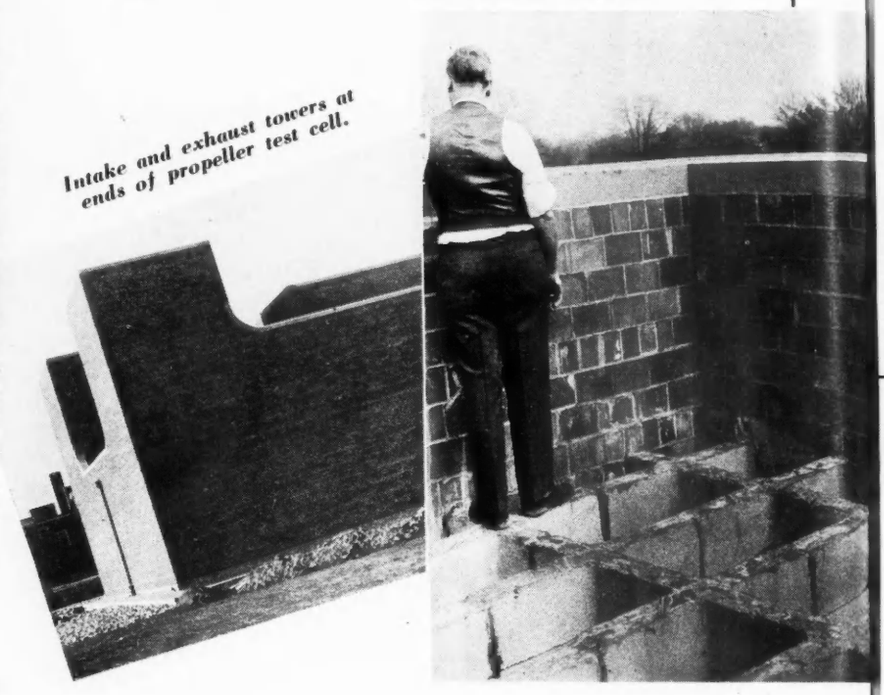
From reliable Government sources it is gathered that in order to fulfill present requirements for our own use and for those countries that come under the provisions of the Lend-Lease Bill, it will be necessary to increase the present orders for military aircraft from 44,000 to 80,000 planes. Full utilization of the 28,000 industrial establishments, not now having any defense orders, must be made for the fabrication of parts which will save valuable time and space.



Interior of propeller test cell with observation window at left, exhaust tower opening at rear, and engine stand.

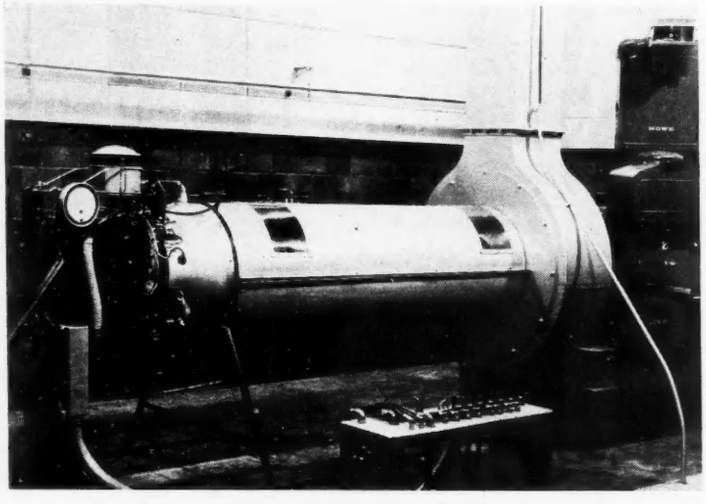
Calistone bricks at top of propeller test cell exhaust tower for absorbing noise.

Intake and exhaust towers at ends of propeller test cell.



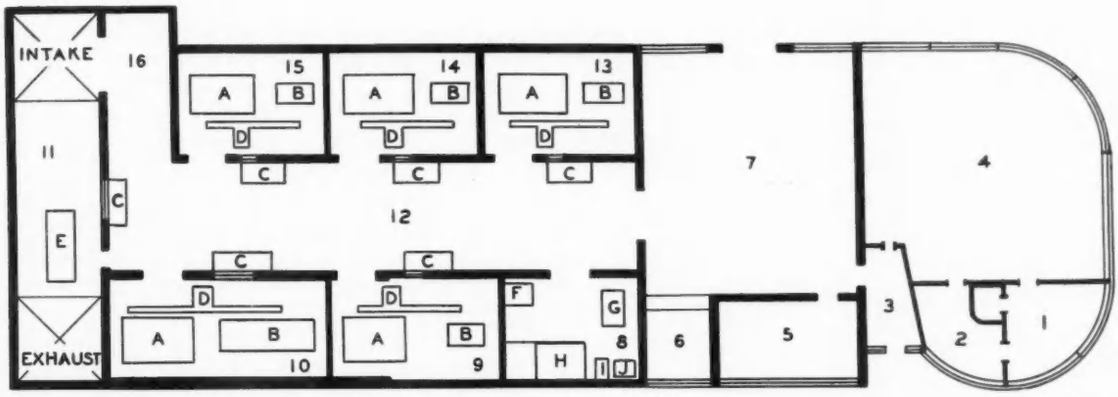
The Wenner-Gren Aeronautical Laboratories

A NEW laboratory for tests and research work on aircraft engines was opened recently at the University of Kentucky in Lexington. It is known as the Wenner-Gren Aeronautical Research Laboratory, having been built with funds supplied by the Swedish industrialist Axel Wenner-Gren, who played a leading role in the development and commercialization of the Electrolux vacuum cleaner and refrigerator. The laboratory is a single-story building of modern design, measuring approximately 50 by 160 ft. Its floor layout is shown by the accompanying drawing.



Interior of dynamometer room with engine in place. At right is weightograph scale.

A. J. Meyer, formerly chief research engineer of the Continental Motors Corp. at Detroit and now professor of aeronautical and mechanical engineering at the university, is director of the laboratory, which will be used for teaching, training, testing and research work, all activities being limited to the aeronautical field. Undergraduates will be taught the laboratory procedure used in aircraft engine plants. Graduates wishing to specialize in this line will be trained as observers and engine-laboratory assistants. Research relating to combustion, lubrication, cooling and mechanical problems will be carried out on single-cylinder engines. Actual engines, both large and small, will be tested on the dynamometers, and endurance tests can be carried out under

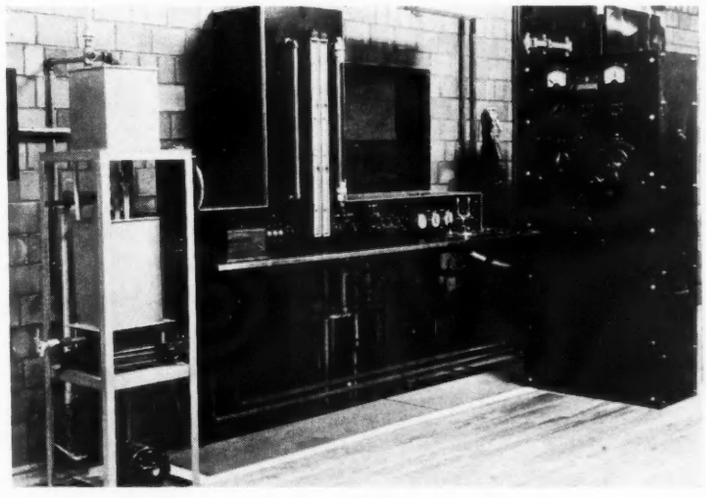


1—Office
2—Secretary
3—Vestibule
4—Drafting room
5—Lockers
6—Tools
7—Assembly room
8—Power room
9, 10—Dynamometer rooms
11—Propeller test room
12—Observation room
13, 14, 15—Dynamometer rooms
16—Vestibule
A—Engine test bed
B—Dynamometer
C—Control panel
D—Control trench
E—Prop. test stand
F—D.C. control panel
G—Motor generator
H—A.C. switch gear
I—Exciter control panel
J—Generator exciter

propeller load. During the immediate future, short intensive courses will be offered with a view to supplying the defense industries with personnel familiar with their problems, methods, and equipment.

A special construction is employed in the propeller test room to prevent transmission of intense noise to the surrounding neighborhood. When testing at wide open throttle without muffler and under propeller load, the sound pressure near the engine is said to often exceed 120 decibles, or a million times higher than at a busy street corner in a large city. The noise problem is aggravated further in a propeller test due to the large displacement of air by the propeller. With a power plant of 1000 hp. on test, the air circulation may amount to 1,500,000 cu. ft. per min. in the Wenner-Gren test room.

To provide an adequate supply of air, there is a tower at each end of the propeller test room, one for the air intake and the other for the outlet, each of which has the same cross sectional area as the room. Large quantities of calistone brick suspended in these towers effectively absorb most sound coming from the test room. The calistone bricks in the form of a cross are supported on steel beams. The arms of the cross are horizontal and the end of each arm touches that of the adjacent brick. In this way air passages are formed, and as the bricks are tapered in the vertical direction, the passage walls have a saw-tooth form. With this construction, only the few sound waves which happen to be traveling in a vertical direction will pass through unimpeded. Any sound wave arriving at the passage wall will be partly absorbed and partly reflected, and it will be practically impossible for the reflected wave to leave the long and narrow passage without again striking the sound-absorbing material. Further, since the bricks are tapered, the reflected wave will be forced down again after a few contacts with the calistone.



Closeup of operator's station in observation room outside of dynamometer room, showing (left to right) oil weighing equipment, pyrometer, manometers, rotameter, engine controls, and electrical control panel.

It has been found that the sound-proofing effect of walls is directly proportional to the weight of material per square foot of wall area. In the Wenner-Gren laboratory all outside and main partition walls are from 13 to 17 in. thick, either double-brick or rein-

(*Turn to page* 546)

Flush Riveting in Aircraft

BECAUSE of its contribution to greater speed by decreasing wind resistance, flush riveting of exterior surfaces on warplanes is now a common practice in both the United States and Germany. The Messerschmitt 110 fighter plane recently received in this country from England for examination by American aircraft engineers is reported to have extensive flush riveting.

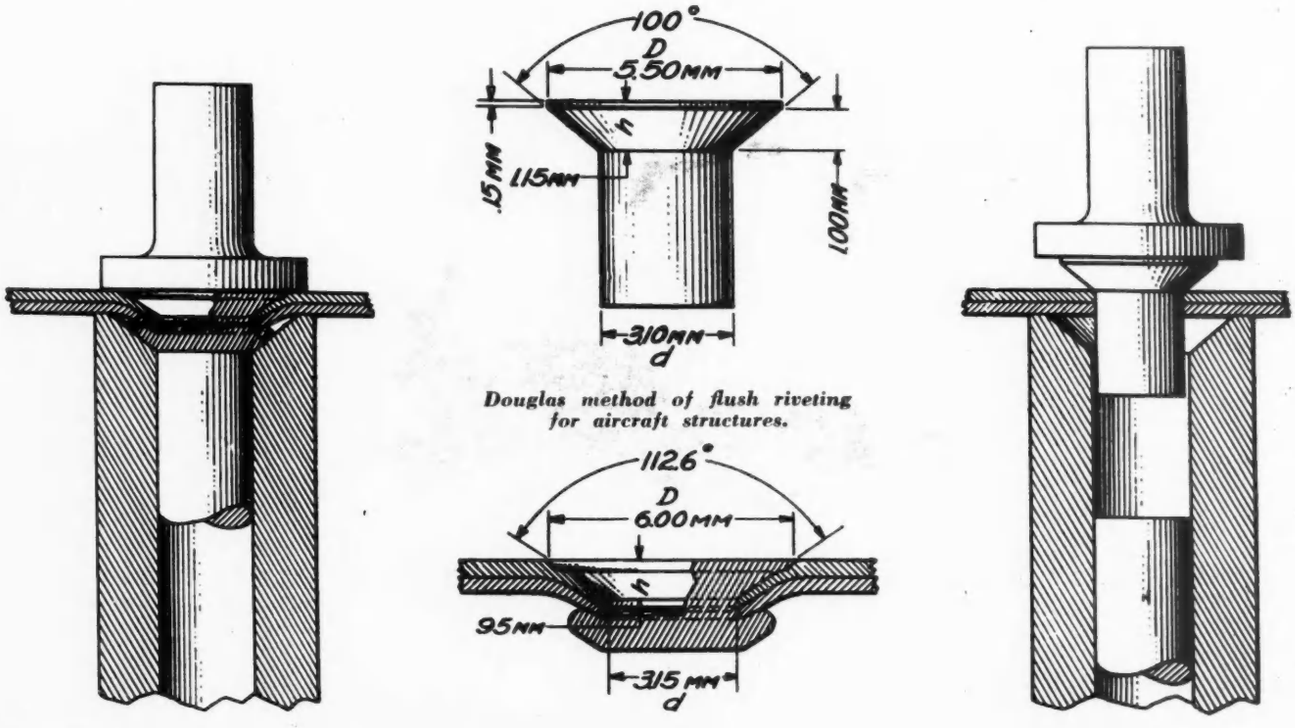
To facilitate production and standardization in the National Defense program, Douglas Aircraft Co. has released its recently patented flush riveting method to the American aircraft industry without cost or liability. This method is particularly applicable in aircraft manufacturing for riveting thin-gage metallic sheets that are used in covering wings, fuselages and similar parts.

The rivet has a cylindrical shank and a head in the form of a conical frustrum with a shallow cylindrical portion added on top, the preferred dimensions being as shown in the drawing. It is inserted into the rivet hole and is dealt a blow or blows on its head, which causes a dimple to be formed that accommodates the rivet head. The force necessary to form the dimple in the sheets produces an extrusion action on the head, increasing its diameter, reducing its thickness, and increasing the angle of the lower surface of the head. This extrusion action is said to produce a volumetric change which may considerably reduce the volume of the head. In the design of the rivet head and the tools used for riveting, the aim has been to reduce to a minimum the loss of head volume, the loss of head height, and the increase in head angle.

Best results are said to be obtained with rivet heads having an included angle of approximately 100 deg. Rivets are made from suitable ductile materials, such as the aluminum alloy A17ST. The volume of the head for the 3.10 mm. rivet, including both the conical and cylindrical portions, is 18.6 cu. mm. and the ratio of the original diameter D to the original height h is 4.78.

In setting the rivet, it is first inserted into the hole in the sheets to be riveted together, with the shank extending into a tubular "bucking tool" countersunk to a taper at its upper end. A riveting hammer is then applied to the head of the rivet, with an impact varying between 9 and 13 ft.-lb. One to two blows of the hammer are sufficient to form the dimple and seat the rivet. One of the particular features of the Douglas method is that the rivet is seated by impact instead of by static pressure. This is claimed to result in a very tight fit between the rivet and the sheet metal, both at the surface thereof and in the hole therein. During the seating operation the cylindrical portion of the rivet head is forced outward and downward so that a flush outer surface is formed. In this operation the head diameter is increased to 6 mm. and the head height reduced to 1 mm. The angle of the under surface of the head is increased to 110.8 deg., the volume of the head is decreased to 16.89 cu. mm., and the diameter/height ratio is increased to 6.00. The final step consists in upsetting the shank of the rivet, which is preferably accomplished with the hammer held against the rivet head so as to act as a bucking tool. The riveting hammer fits snugly in the tubular bucking tool used in the seating operation.

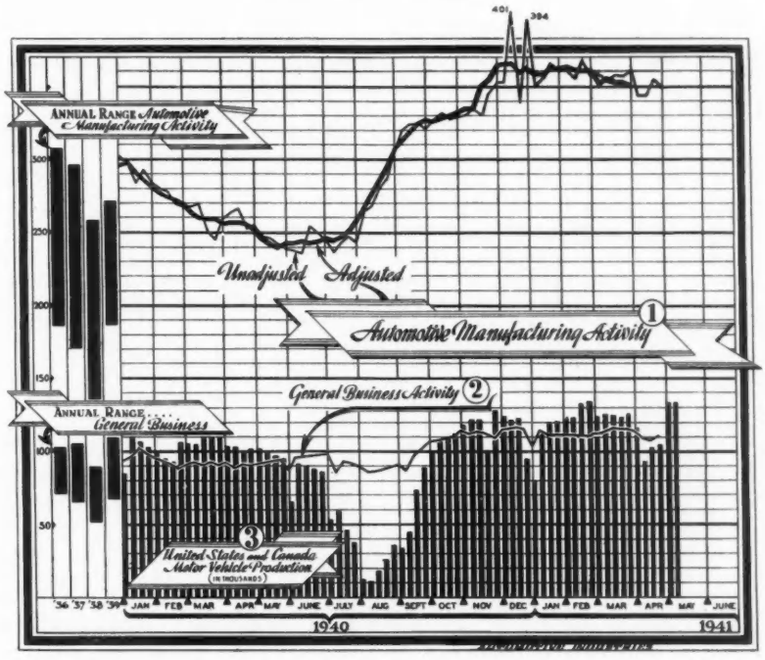
The accompanying illustrations show the rivet in its original form, the rivet when set, and the riveting operations.



Douglas method of flush riveting for aircraft structures.

WHAT THE INDUSTRY IS DOING

[*Our own view of automotive production and sales; authoritative interpretation of general conditions*]



Weekly Indexes of Automotive General Business

Priorities May Force Further Curtailment

PARING of 1942 model production to 4,224,152 units, a reduction of 20.15 per cent over the estimated 5,289,972 vehicles to be manufactured in the current model year, has stimulated sales to the extent that 1941 production has reached the highest level since the spring of 1937. The Office of Production Management on May 3 notified the automobile manufacturers of their individual allotments of motor vehicles to be manufactured from Aug. 1, 1941, to July 31, 1942. Details of the curtailment, such as its application to types of vehicles, is left to the manufacturers.

According to the OPM announcement, "The allotments to individual companies give due regard to the necessity of maintaining the relative position of the different companies in the industry, their size, field organization employment and their relative position in regard to passenger vehicles and trucks."

Small companies making less than 2000 units were not curtailed. Manufacturers of trucks exclusively, such as International Harvester, GM Truck, White and Mack, were reduced 5 to 10 per cent. Medium-sized passenger car companies, like Studebaker, Hudson, Nash and Packard were curtailed approximately 15 per cent, while the large companies, General Motors, Chrysler and Ford, were reduced 21.5 per cent.

The OPM further asked that the greatest possible economy be exercised in the use of such critical materials as neoprene, nickel, chromium, magnesium, ferrotungsten, nickel steel, zinc, copper and aluminum.

W. S. Knudsen, director of OPM, had previously said there are no plans now for a further cut in production, and the OPM announcement said that due notice would be given the industry in case of a further reduction in critical material allotments.

However, some manufacturers look for a further reduction in 1942 model production, if not by agreement between the companies and the OPM, then through the operation of priorities on men and materials due to the greatly accelerated national defense program under the Lease-Lend Bill.

In making his report on the operations of the Chrysler Corp. for the first quarter of 1941, President K. T. Keller asserted that under present priorities it may be difficult for the corporation to attain its 1942 model schedule due to material shortages. He also said that diversion of an increasingly large proportion of Chrysler effort to defense work is "certain to involve more or less inconvenience to the public and to our dealers. higher prices to the public . . . restricted volume of business for the dealers and lower profits." General Motors has defense contracts totaling $750,000,000, Chrysler government orders amount to $196,000,000, and Ford's total $154,000,000.

Meanwhile, production set a four-year high as an estimated 290,000 vehicles were produced in the first half of May. Unless a threatened strike in the General Motors plants should materialize, total output for May is likely to fall only a few thousand units short of the 553,231 units produced in April, 1937, which is the biggest total for any month in the last 10 years. The month has 21 normal working days, but Ford

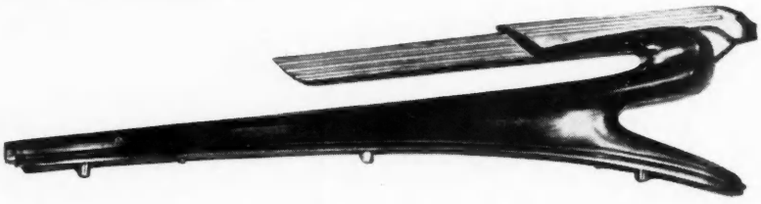
(*Turn to page 544, please*)

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. of New York. 1926 = 100: [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

Lead Base

By J. C. Fox*

BECAUSE of their low melting points, low shrinkage and general ease in casting, lead base alloys were the first to be used in the development of the die casting process. These properties together with other characteristics, such as anti-friction properties, corrosion resistance, resistance to attack by strong mineral acids, resistance to the passage of X-rays, and high unit weight have resulted in the application of lead die castings for many varied uses.



Chevrolet radiator ornament

Lead base alloys have relatively low strength and hardness, especially at temperatures considerably above normal and it should be recognized that they are not conducive to general and wide usage for structural purposes. As with other metals and materials, care must be exercised to apply lead alloys properly where they belong and in accordance with their mechanical characteristics. Radio grilles, radiator ornaments, fender ornaments and lamp frames so fabricated, and similar parts which are not subject to undue stress or to elevated temperatures in service are being used satisfactorily.

Lead base alloys have low casting temperatures and excellent casting properties. The average casting temperature is placed at 600 deg. Fahr., but certain alloys are quite fluid as low as 490 deg. Fahr. or near the freezing point.

As in the die casting of other alloys, attention must be directed to establishment and maintenance of proper conditions in the casting operation to produce the best results. The temperature of the alloy in casting as well as the temperature of the die must be most carefully regulated and controlled. The rate of cooling influences to a large degree the miscostructure and the physical properties of the casting. High casting temperatures may lead to slow cooling which may result in a comparatively coarse structure and segregation of certain constituents in the alloy.

Antimony has been the chief alloying and hardening agent in lead alloys. The antimony content may range from a fraction of 1 per cent to as high as 20 per cent, but when as high as the latter, a third element, usually tin, is added to reduce brittleness.

Alloys containing 4 to 5 per cent antimony are used in the casting of battery grids, connections, fire extinguisher nozzles and other similar parts. The most useful alloys for die casting, however, are those containing from 10 to 13 per cent antimony. These alloys have good casting properties and higher strengths than the lower antimony content alloys.

The equilibrium diagram between lead and antimony shows that at 12 per cent antimony, an eutectic mixture is formed with a freezing point of 476 deg. Fahr. Lead-antimony alloys are capable of some age-hardening by dispersion of the antimony in the lead due to the difference of solubility of antimony at the eutectic temperature and at room temperature. The solid solubility of antimony at the eutectic temperature is about 2.45 per cent. This solid solubility decreases to about 0.25 per cent at room temperature. Therefore, antimony can precipitate out of solid solution causing dispersion hardening. The agglomeration of the precipitated particles brought about by reheating to elevated temperatures results in softening of the alloy.

Cadillac radiator ornament

While there are many uses for the simple antimonial lead alloys, the trend has been toward the development of more complex alloys in which the addition of tin, arsenic, copper, tellurium, nickel and bismuth or other elements along with antimony may be made for the purpose of improving mechanical properties, hardness, creep strength, fatigue strength, and also for stabilizing such properties at temperatures above normal.

The addition of small amounts of tin to lead antimony alloys increases their rigidity without increasing brittleness as much as would be found with a corresponding amount of antimony. Tin enters into solid solution in both antimony and lead and is present in the compound that forms the cubes of solid solution SbSn.

* Chief Metallurgist, Doehler Die Casting Co.

Alloy Die Castings

Arsenic additions to lead-antimony alloys are effective in preventing segregation. Arsenic also raises the strength and hardness and normal temperatures and helps to stabilize the mechanical properties at elevated temperatures.

The lead-antimony alloys can also be hardened with copper. When the tin content is appreciable the light SnSb cubes may tend to segregate and float to the top. Copper added to the extent of 1 to 2 per cent will prevent such segregation, through the formation of a web-like structure which entangles the cubes and prevents their floating out. In low tin content alloy, there is less tendency to segregation and copper may not be necessary.

An alloy of this type which is being used extensively for die casting, known to the trade as "CT" alloy, bears the following composition.

Antimony	12-13 per cent
Tin	Max. 0.65 per cent
Arsenic	" 0.65 per cent
Lead	Remainder

Another alloy* recently developed and patented contains approximately 12.5 per cent antimony, 3 per cent arsenic, 0.75 per cent tin and remainder lead. Tests conducted at normal and elevated temperatures show this alloy to possess tensile properties and hardness superior to other standard lead base alloys and as good as tin base alloys of the standard babbitt type. Furthermore, it is said to retain higher hardness when subjected to elevated temperatures for long periods, whereas other alloys show greater amount of softening under these conditions. This alloy has a solidus line at 468 deg. Fahr., and liquidus at 563 deg. Fahr. It has good casting properties and retains its composition well under numerous remeltings.

The corrosion resistance of lead and its alloys is such as not to require any finishing for protection. When it is necessary to finish for decoration, lead base alloys can be electroplated or painted with the same facility as other metals.

By following the proper plating technique, plated coatings on lead die castings will remarkably withstand the severe salt spray, high humidity and other accelerated laboratory tests. The results of many such

(*Turn to page* 548, *please*)

Mechanical Properties of Various Land Base Alloys

determined on die cast specimens at room temperature (68 deg. Fahr.)

Percent Composition				Specific Gravity	Tensile Strength P. S. I.	Elongation Percent	Brinell Hardness	Expansivity Coefficient
Antimony	Tin	Arsenic	Lead					
5.	....	....	95	10.95	6900	8.	9.2	0.0000275
10.	....	....	90	10.59	8000	6.	13.5	0.0000262
12.	....	....	88	10.45	9300	5.25	14.5	0.0000256
12.5	0.65	0.65	Rem.	10.38	9800	5.50	18.	0.0000251
12.5	0.75	3.0	Rem.	.....	10200	2.80	22.	.....

* American Smelting & Refining Co.—U. S. patent 2232185 Feb. 18, 1941.

Top (below) and reverse side of Cadillac rear fender ornament

METALLURGY

Producer Gas is the Motor

By Hans A. Branders

When producer-gas equipment is to be installed in a motor vehicle, several means are available for reducing the approximately 40 per cent loss in engine power.

1. When peak load is required, gasoline can be used as fuel, either by adding it to the gas mixture or by running on gasoline alone. In either case the gasoline is fed through a carburetor, and the flow is regulated by a mixture valve. If peak loads have to be carried often, the gasoline equipment will be used frequently, with the result that the producer will be loaded intermittently and the gas-producing conditions will be unfavorable, owing to the intermittent draft. The gas, moreover, will be of poor quality. This system, therefore, is low in efficiency, and the gasoline consumption is relatively high.

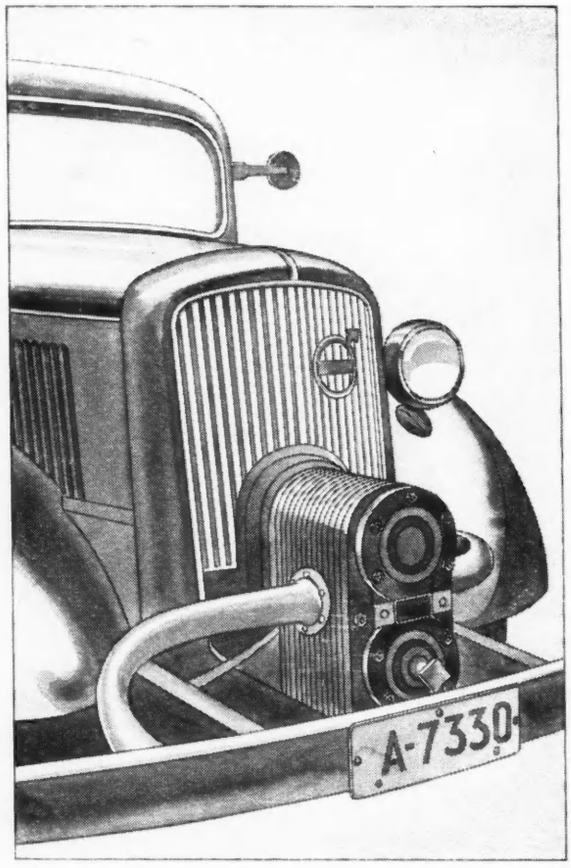


Fig. 5 Supercharger installation in the Sysi system

2. In order to increase engine power, the compression ratio of the engine can be increased to about 8 or 9, because the gas/air mixture will stand a higher compression pressure than the gasoline/air mixture. An increase in engine output of 20-25 per cent can thus be obtained, compared with an engine of the usual compression ratio for operation on gasoline. The total power output with this system is thus 70-75 per cent of the output obtained when running the engine on gasoline. A grave disadvantage of this system is that when higher compression ratios are employed, gasoline cannot be used as fuel in the engine, even for starting purposes. Special detonation-proof fuels or blends must be used. Starting is made more difficult, particularly in the cold season, because of the inferior starting characteristics of these blends, compared with gasoline.

3. An oversize engine can be installed in the vehicle, in order to compensate for power losses. An engine with a piston displacement 30 to 40 per cent larger than that of the normal gasoline engine used in the vehicle, and possibly with a slightly higher compression ratio than that usually employed for gasoline, will deliver the same output running on gas, as the original engine running on gasoline. However, weight distribution and space avaliable are factors which limit the possibilities in this direction. There are comparatively few vehicles in use in which it is possible to install an engine of sufficiently large displacement to compensate for the power loss due to running on gas.

4. By supercharging the engine with gas/air mixture, the power loss due to the inferior fuel used can be totally compensated. Extensive tests have been made with various types of superchargers. The centrifugal type has proved to be unsuitable, because its pressure and volumetric-efficiency characteristics do not meet the requirements at various loads and engine speeds. The Roots-blower type of supercharger has been tested with good results, but its noise renders it impractical. A displacement-type rotary blower has been used with excellent results in Finland. A supercharging pressure of about 6 lb. per sq. in. proved to be suitable. The resulting compression pressure is thereby increased only about 40 per cent, and the maximum pressure correspondingly, these pressures being little higher than the maximum values encountered when running on gasoline.

The supercharger is installed in the gas line between mixing valve and engine. Between supercharger and engine a four-way valve is provided (see Fig. 3). The engine is started on gasoline. The supercharger draws air through the gas-producing system, and discharges

Fuel of Finland

***This is the concluding instalment of an article by Hans A. Branders Part 1 of which appeared in the May 1, 1941 issue of* AUTOMOTIVE INDUSTRIES.**

the gas/air mixture into the open. After the gas quality has become suitable for engine operation, the system is switched over to running on gas. Between supercharger and engine a check-valve and a safety valve are installed. The former is necessary to safeguard the supercharger against excessive pressure and temperature rises. Through the safety valve excess gas is blown out into the open, when the engine is idling at high speed. A slight waste of gas is thus permitted to obtain a good quality of gas whenever needed. When the engine is running with closed throttle, the blower provides good draft in the gas producer. In a gas-producing outfit without supercharger, the draft in the producer is closely controlled by engine suction or throttle position.

A serious disadvantage of the described supercharger system is the difficulty of providing a drive for the blower. The supercharger is a rather bulky piece of equipment, and the space available for it under the hood in present-day vehicles is insufficient. The device can be most readily installed in front of the radiator and driven from the front end of the crankshaft, but unfortunately in that location it is almost sure to be wrecked in a head-on collision. (Fig. 5.)

Another disadvantage of the supercharger installation is the high price of the equipment. Depending upon the design of the supercharger used, the gas must be very carefully cleaned, because even small particles of soot or grit may destroy the bearing surfaces and working parts of the supercharger. Cleaners for installations including a supercharger must, therefore, be more effective than cleaners for other systems.

Fig. 6 shows the check valve and the safety valve installed in a supercharger-fitted system.

Producer gas can be used as fuel with advantage even in passenger cars. The gas-producing outfit either is mounted on a special one-wheel trailer which is connected to the rear bumper of the car in such a manner as to have no lateral freedom, or it is installed in the trunk of the car itself. This last method of installation has several drawbacks, however. The weight distribution of the vehicle is materially changed; its steering qualities are adversely affected, and the rear cross member of the frame usually has to be either removed or cut, to make room for the producer.

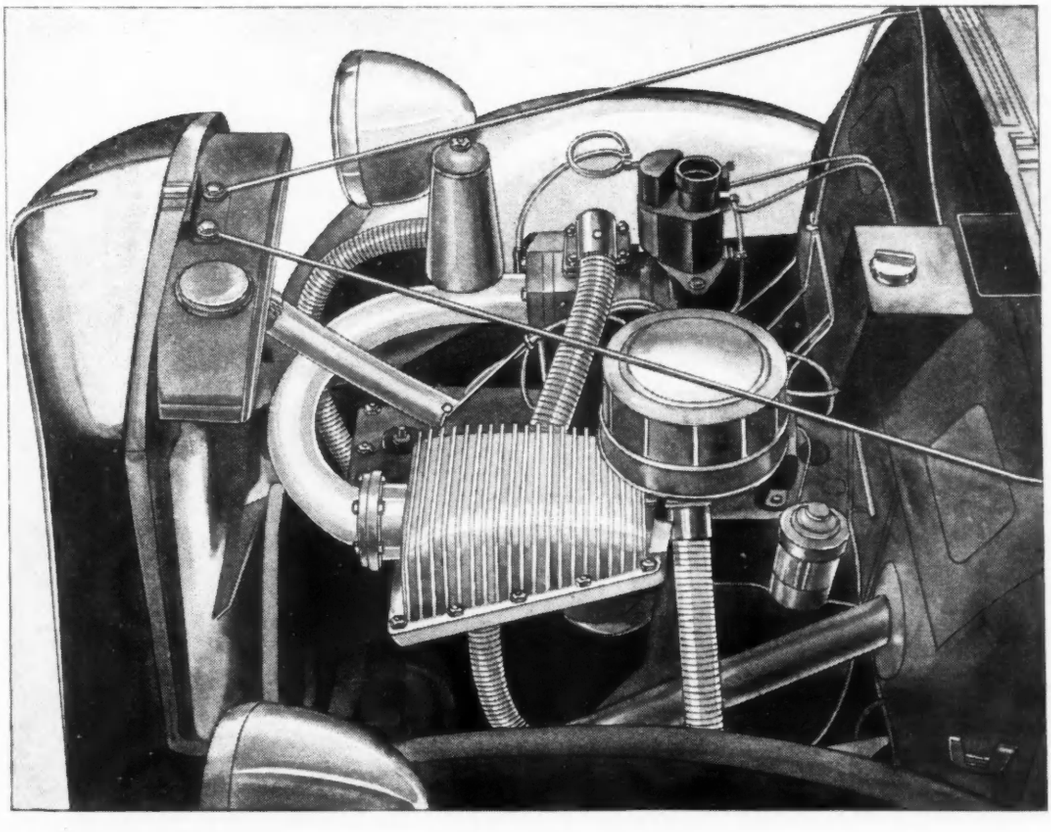


Fig. 6 Safety valve and check valve in the Syst system

Automotive MATERIALS

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Specifications for Replacement Materials

WHEREVER men of industry gather these days, the supply of raw materials and possible replacements in case of shortages usually become the main topic of discussion. Current shortages of metals are attributed in a large measure to the accumulation of excessive stock piles and tonnage in process. To prevent this condition the OPM priorities division has invoked an inventory control system covering 16 classes of metals.

At an open conference at Franklin Institute, Philadelphia, it was announced that alternate or emergency specifications for replacement materials will be drawn up by both the Federal Specifications Board and the American Society for Testing Materials. Speakers stated that at present there is enough manganese ore in this country to keep the steel industry going until the beginning of 1943 and that chromium ore supplies are adequate for 14 months.

In Detroit at another ASTM meeting, Dr. J. S. Laird of the Ford Motor Co., said that the motor car industry would be prepared to rely exclusively on organic finishes should acute shortages develop in nickel and chromium. Already the industry has reduced the thickness of nickel to one-third and its metallurgists are considering the use of chromium plated directly over a heavy layer of copper. As far as chemicals and plastics used in the automobile industry, Dr. J. K. Hunt, a du Pont representative, believes there is no danger of a shortage. E. C. Smith of the Republic Steel Corp., predicted that the steel demand will rise to 105 million tons this year, 14 per cent greater than present capacity of the industry.

Curtis Sleeve Bearing is Fusion Bonded Type

UNIQUE type of sleeve bearing for general use has been developed by the Curtis Development & Mfg. Co., Milwaukee, Wis. This Evans "fusion bonded" steel backed, babbitt lined bearing is said to have excellent non-scoring properties and high load carrying capacity.

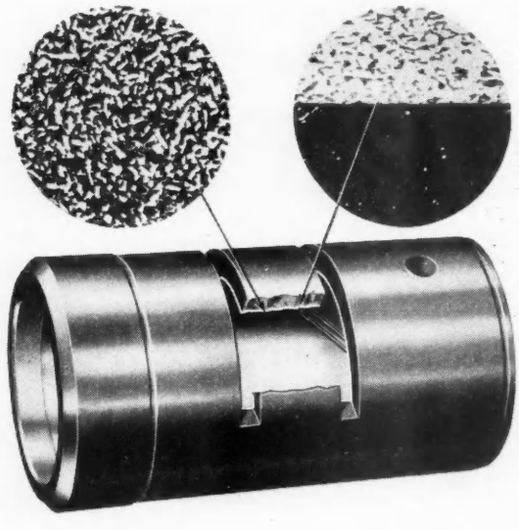
Two outstanding characteristics of this bearing are emphasized by the producers, as illustrated. First is the definite junction or bond between the lining and the steel back which prevents flexing and ultimate cracking. Note the micro-photograph at the right (X100).

The second feature is that of uniform structure, as indicated in the micro at the left (X100). The bearing is said to have good conformability and embedability, non-scoring properties, and maintenance of hardness values at elevated temperatures. It is being produced in a range of sizes from 1.125 to 4.00 in. inside diameter.

American Nickeloid Co. Offers Crimped Patterns

INTRODUCTION of several interesting, new crimped designs in bonded pre-finished metals has been announced by American Nickeloid Co., Peru, Ill. One of them, termed a 7/16-in. crimp, is available in horizontal, diagonal, square, and diamond patterns in a variety of metal thicknesses. Sheet sizes available in most patterns range up to 24 by 36 in. The second design, termed an oval crimp, is introduced in two widths, ⅛ in. and 3/16 in. long, continuous coils, and in gages ranging from 0.010 to 0.015 in.

Both crimps are offered in bright or satin finishes of nickel, brass, chromium, or copper, with electro-bonding to basic metals of steel, zinc, or brass. The rounded contour of the oval crimp makes it very adaptable for inlay purposes. The 7/16-in. crimp, is being offered for a variety of purposes including reflectors, stove pads, electrical appliances, display stands, signs, and any application that requires a new decorative treatment.

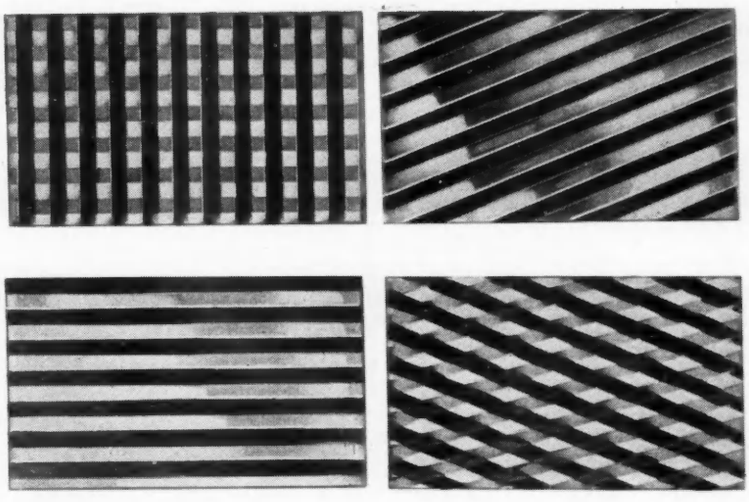


Micro-photos of babbitt lining and bond in Curtis bearing.

Durez 775 Black Molding Compound

A NEW general-purpose phenolic molding compound is announced by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. This material is to be known as Durez 775 Black.

It was developed to make available a material with a wide range of application. Among its improvements are listed: Lower water absorption, slightly higher flexural and tensile strength, and heat resistance of 400 deg. Fahr. It is also stated that Durez 775 Black has excellent molding characteristics, fast cure, and will deliver a smooth, lustrous finish.



Variety of designs in American Nickeloid crimped patterns.

du Pont Develops Liquid Metal-Deactivator

A NEW metal deactivator designed to increase the storage stability of petroleum distillates has been developed by the Petroleum Chemicals Section of E. I. du Pont de Nemours & Co. It is recommended for both gasoline and fuel oils containing soluble metallo-organic compounds or soluble metal salts of organic acids in which it will counteract the pro-oxidant or catalytic effect of these contaminants.

Response of gasolines and fuel oils to the metal deactivator is governed largely by the nature and content of the metal catalysts present in the distillates being treated. Experience has indicated that the useful range lies between 0.0001 per cent and 0.002 per cent by weight, although in some instances as much as 0.005 per cent may be required.

Properties of this deactivator, a liquid that is claimed to remain stable in storage, are listed as follows:

Specific gravity, 60 deg./60 deg. Fahr.	1.076
Pounds per gallon at 60 deg. Fahr....	8.96
Pour point	0 deg. Fahr.
Viscosity at 100 deg. Fahr.	125 S.U.S.
Flash point (T.C.C.)	100 deg. Fahr.
Fire point (C.O.C.)	135 deg. Fahr.

Marlox Plastic Coating Protects Metal Surfaces

MARLOX, a plastic coating for metals, is being introduced to the industrial market by Marley Chemical Co., Detroit. It is a plastic coating of the structural type for use either as a priming coat or purely for protection against rust and corrosion. Chief among advantages claimed for Marlox is almost complete absence of porosity. Marlox may be applied by spraying, painting or dipping to form a thin, flexible coating on any metal.

Marlox is said to dry quickly and can be handled in five to ten minutes after applying. One hour's drying time is recommended where possible, before applying enamels or paints.

Where weight is a factor, it is claimed that Marlox saves 50 per cent of the weight of the conventional primer. It can also be used to waterproof cement.

Caloria Lubricating Oil for High Temperatures

A LUBRICATING oil which does its work, then vanishes without a trace, is being introduced by the Esso Marketers to industries faced with problems of lubrication at extreme high temperatures. This new oil, known as Caloria, is designed to solve an old problem of lubrication under intense heat, such as is found in kiln cars, glass making machinery, ceramics and glass molds, annealing and baking ovens, working parts of die casting machines, and various hot parts of machines in the metal industries. Caloria, recommended only for temperatures above 400 deg. Fahr., is available in several viscosities ranging from a light-bodied water-white liquid to a viscus, slightly turbid liquid.

In addition to its ability to disappear completely under high heat, Caloria is said to spread to only four or five times its original area, assuring that it will lubricate bearing surfaces adequately under high heat before evaporation. Replenishing must be regulated according to the conditions of service.

Laminated Cam Blanks Cut Production Time

A MORE economical and efficient method for producing cams for Brown and Sharpe automatic screwing machines has recently been developed by the Synthane Corp. These cam blanks are fabricated from laminated sheet stock fabricated with Bakelite resin laminated varnish. Only a fraction of the time formerly required to turn out a set of blanks in metal is

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What Can Be Done with

TODAY'S CEMENTED CARBIDE T

By JOSEPH GESCHELIN

CEMENTED-CARBIDE tools, a major factor in the economy of metal cutting for the past ten years or more, have produced a virtual revolution in the cutting of steel during the past year or so. The new steel-cutting grades supplied by a number of producers have served to greatly increase the tempo of national defense by speeding up the productivity of new machine tools, by helping to get the most out of the older items of equipment.

In addition to the cemented-carbides, machine shop operators have had the advantages of several types of cast carbide tool materials, as well as the steel cutting grades of the well-known Haynes-Stellite alloys.

Doubtless the greatest impetus to the application of hard cutting alloys on steel came early in 1940 when the high strength, crater-resistant compositions became available at extremely low prices. Not only did this widen the scope of the cemented-carbides for the general run of steel cutting operations but it encouraged the adoption of these tools on roughing operations, often on rough forgings and bars and steel castings with interrupted cuts.

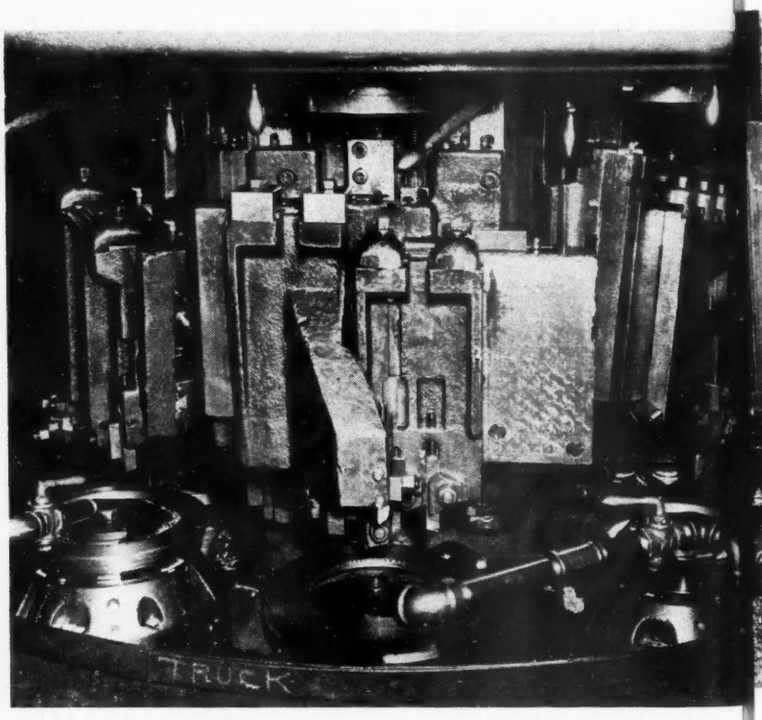
A current report from one of the largest aircraft engine builders in this country gives an excellent picture of what has been accomplished. This concern, using Carboloy tools, has succeeded in increasing productivity from 20 to 300 per cent as compared with high-speed-steel practice, the average improvement being of the nature of 40 per cent. This company has applied Carboloy on 70 per cent of lathe operations and 100 per cent of all precision boring on Heald and Ex-Cell-O machines. This activity is said to be rapidly extended to other metal cutting operations including milling.

According to the tool engineer of the company, cemented-carbide steel cutting grades promote several outstanding advantages. One is the ability to machine heat treated steel alloy parts with facility; the other is the attainment of fine surface finish which quite frequently eliminates the polishing operations usually specified.

In our own experience in recent months we have noted a few important items of steel cutting in ordnance work that are worthy of special mention. In one case, there is the rough turning of machine gun rifle barrels from the rough bar in Lo-Swing lathes; in another case the turning of shell forgings from rough to finish. Too, we have observed the experimental use of Carboloy on one of the spindles of a new rifle barrel drilling machine.

In a recent talk entitled, "Steel Cutting Carbide Tools; Their Design and Power Requirements," Phillip M. McKenna, McKenna Metals Co., pointed out that steel cutting has been expedited by the development of crater-resistant intermetallic compounds, harder than the familiar cemented-tungsten-carbide. The material made by his company is essentially a tungsten-titanium-carbide with binders of carburized tungsten and cobalt, cemented in vacuum electric furnaces.

Kennametal tools are made in three grades of hardness by varying the proportions of the ingredients, are said to have the requisite strength and hardness



Rough-facing truck axle ring gears made from SAE 4615 forging, 143-163 Brinell. Operation on Bullard Mult-Au-Matic, using Haynes-Stellite Star J-Metal tools. Surface speed is 161 fpm., depth of cut ⅛ in.

TOOLS

for machining steels up to 550 Brinell in hardness. Such tools have a certain degree of elasticity, are free from localized embrittlement, and may be reground many times. Moreover, surfaces cut with such tools are typically smooth.

Vascoloy-Ramet Corp., pioneer producer of cemented-tantalum-carbide steel cutting tools, reports that its product, which is a mixture of tantalum carbide and tungsten carbide, has widely extended useful applications due to the introduction of some new grades. Unique property of these tools is the elimination of "cratering" commonly encountered when handling materials which cut with a continuous chip.

Another important development is the perfection of a cast alloy containing tantalum-carbide. Tantung "G" is composed of a matrix of tungsten, cobalt and chromium, containing distributed particles of tantalum carbide. This material is intended for steel cutting, principally for application on the older and slower speed machine tools, in an effort to obtain the greatest possible production from such equipment. This material is expected to be particularly useful in national defense work which may be handled on the older machines.

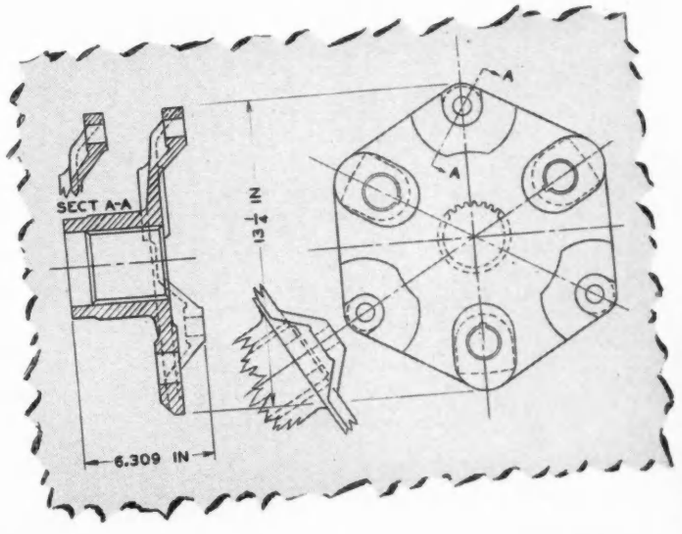
In the interest of better utilization of cemented-carbide tools, Carboloy has issued an engineering bulletin on the subject of machining steel. The latest edition of the bulletin covers such topical headings as—tool shape, tip thickness, coolant, chip breaking, etc., making it an excellent working guide for the tool engineer.

James R. Longwell, chief engineer, Carboloy Co., Inc., has been promoting the use of standardized tools, on the principle that the average plant can use one standard grade for practically all steel turning and facing operations. His work has shown that it is possible to cover the tool requirements of 60 to 80 per cent of all carbide operations with single point tools through the use of the standardization procedure.

As an adjunct to this, Longwell also has recommended a system of interchangeable tool holders to reduce machine down time. From an ideal standpoint, it would be desirable to eliminate all tool adjustments on the machine. While this is not practicable, it is perfectly feasible to reduce the time lost in changing tools by making the major adjustments in the tool room. This principle is facilitated by the development of specially

(*Turn to page* 550, *please*)

Bullard Mult-Au-Matic operation on a tractor brake drum made of SAE 1040 steel. The operation shown here is that of finish-turning the hub diameter and O.D. using Carboloy tools. The drum is 11 in. in diameter and is turned at 208 rpm., making the surface speed on the O.D. about 600 fpm. Feed is 0.015 in. per revolution, depth of cut—0.02 to 0.025 in.



Sketch of the chromium-nickel cast steel planetary gear carrier machined with grade KM, Kennametal tools on a Warner & Swasey turret lathe. An outstanding example of interrupted cut metal removal with a speed of 168 fpm., and depth of cut ranging from ⅛ to ¼ in.

MEN

MACHINE tool equipment now installed in plants of this country could readily yield at least 10 per cent more output per hour for defense needs under proper tooling and operating conditions, and in many cases considerably more, President F. V. Geier of the National Machine Tool Builders' Association, told its members at their annual spring meeting in Cleveland. To step up the output, he suggested operating equipment more hours per week, releasing critical machines from non-defense industries, and that conditions be established to assure full output of each unit. At the present time over 1000 machine tools of a wide variety, enough to equip a good-sized defense plant, are being delivered every day to defense plants, he said.

FOR FINE tolerance measurements on work difficult to handle and also to eliminate the necessity of removal from the machine, Pratt & Whitney, of West Hartford, Conn., now offers the Electrolimit snap gage designed for precision accuracy of ten-thousandths of an inch. This portable gage, which is light and easy to handle, utilizes an electric circuit that magnifies any errors into an easily read needle movement on a dial.

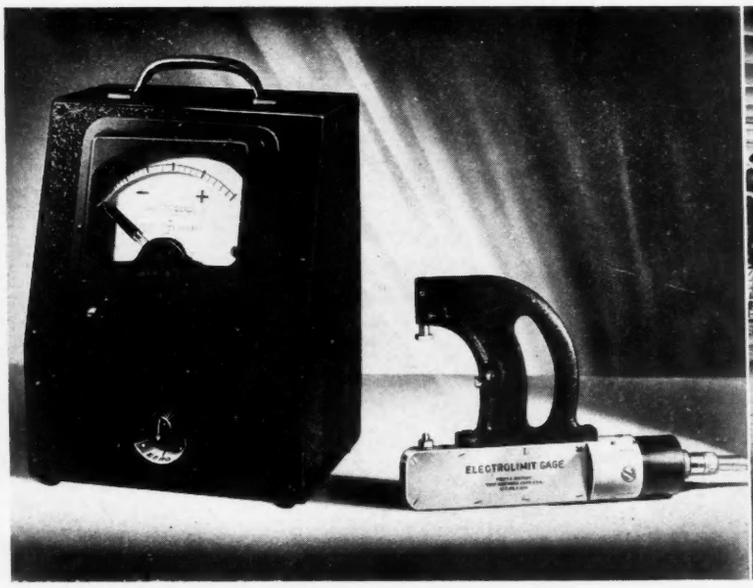
Available are two gage bodies and several sizes of frames for each body. By using the right combination, the Electrolimit snap gage can be arranged for dimensions from ½ in. to 6 in. The two smallest frames have ¼-in. adjustment and all others ½-in. adjustment. If several diameters are to be checked, Pratt & Whitney can furnish a portable instrument cabinet, a selector switch and connections for several gage heads.

In its adjustable limit snap gage line, Pratt & Whitney has AGD and Trusform gages for checking maximum and minimum diameter in one operation. The AGD gage frame is made in accordance with the design adopted several years ago by the American Gage Design Committee. The AGD gages are made in four models—Model A and B types with four adjustable anvils and Model C and MC types with one solid and two adjustable anvils. The Trusform Model C is a quality gage with one solid and two adjustable anvils.

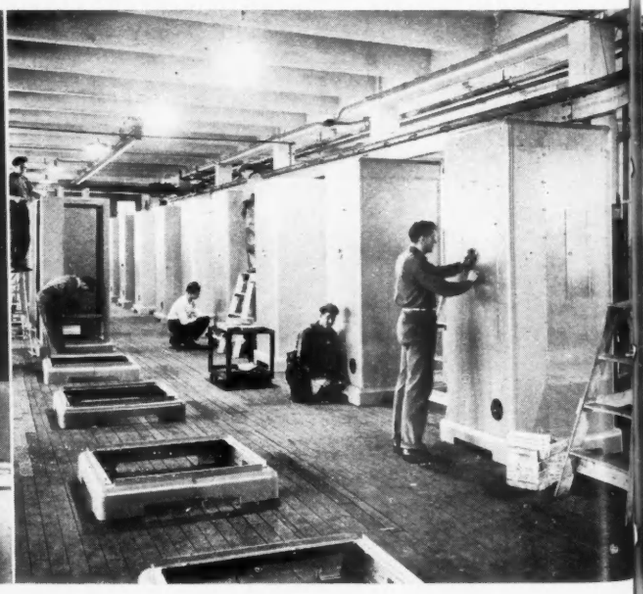
AN ORDER of 264 steel cubicles for a new defense plant was completed recently by The Kirk & Blum Mfg. Co., Cincinnati. The illustration shows a part of this order in the production line in various stages of assembly. These cubicles house and protect all wiring, piping and switches for power, light, telephone and compressed air control and distribution. They not only improve the general plant appearance, but facilitate inspection and repairs and prevent tampering with vital equipment.

BRUCE PRODUCTS CORP., Detroit, has announced the addition of several new models of polishing and buffing machinery in 3, 5, 7½ and 10 hp. units. These adjustable speed, single or double spindle lathes are equipped with Reeves Motor Drive internal mechanisms, easily adjusted through the speed range by small indicators on top of the lathe. The shafts of

New Pratt & Whitney Electrolimit snap gage



Kirk & Blum steel cubicles on assembly line



and MACHINES

these mechanisms are chromium plated.

Wheel spindles are precision machined from X1335 S.A.E. steel and each spindle is checked for dynamic balance. Wheel spindle bearings are high capacity type, full floating mounted, and effectively enclosed to prevent leakage of lubricant and entrance of abrasive dust. All lathes are tested at speeds well beyond their maximum rating.

TRABON ENGINEERING CORP., Cleveland, announces the development of the Trabon non-reversing, single inlet, multi-outlet distributor and the Trabon Series MP variable feed, multi-outlet pump to provide in combination a centralized lubrication system for hobbing machines, lathes, milling machines, presses, screw machines and similar machinery. The distributor consists of a bank of three or more sections, each of which discharges a measured quantity of lubricant alternately through one or two discharge outlets that are connected directly to bearings. The volume of the different sections of the same distributor may vary from 0.005 to 0.035 cu. in.

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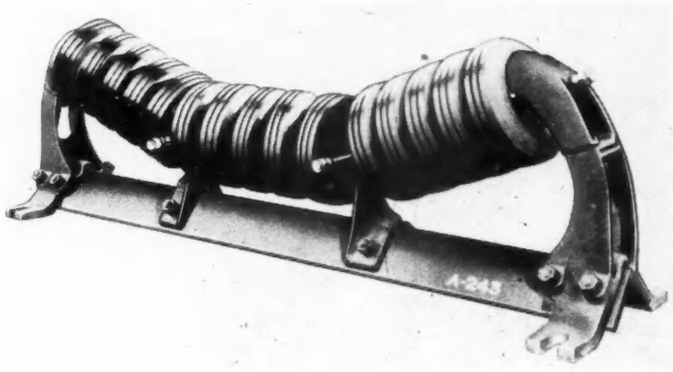
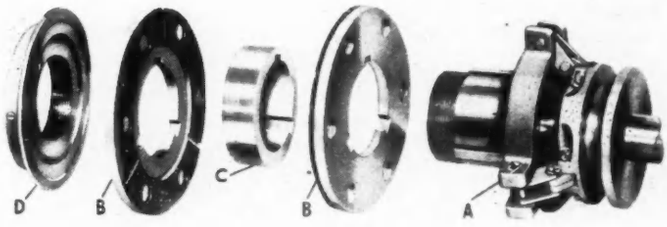


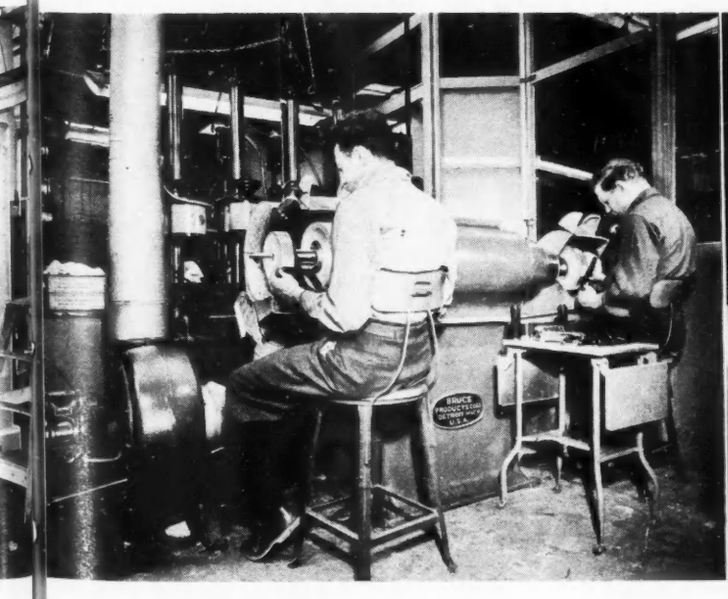
Stephens-Adamson impact carrier

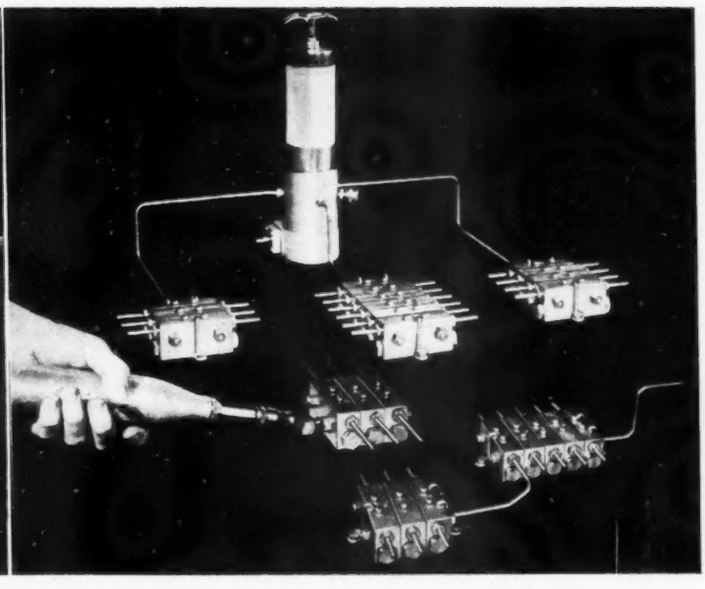


Rockford LMC clutch

Various combinations of Trabon centralized lubrication system distributor operated manually with a pressure gun; distributor fed from another distributor; and a 6 outlet, 12 outlet, and 8 outlet distributor connected to a Series MP variable feed multi-outlet pump.

Bruce polishing machine





Details of

IN THE early part of April, a complete Messerschmitt Me-110 multiplace fighter arrived in Los Angeles Harbor aboard the freighter Montanan, consigned to Vultee Aircraft, Inc. The squadron designation of this particular example of Germany's most highly publicized war plane is S9CK. It was brought down with comparatively slight damage during combat over England, carefully dismantled, and shipped to Vultee for the purpose of engineering investigation and study; in order that the entire American aircraft industry may benefit from a complete knowledge of the airplane representing the best efforts of German airplane designers and production engineers.

After viewing the Me-110, one is impressed by the fact that here is an airplane designed for "Blitzkreig" —an airplane provided with terrific striking power, but with practically no defensive armament or armor. Four .30 cal. machine guns and two 20 mm. cannon, tightly packed into the nose of the fuselage, provide heavy fire power, and contrast sharply with the single flexible machine gun supported on a primitive mount in the aft cockpit. A quickly detachable external bomb rack designed to carry two 550-lb. bombs is provided for use on missions wherein attack of ground objectives would be the principal purpose.

The almost total absence of defensive armament indicates that S9CK was designed for the dual purpose of providing a military airplane having both heavy striking power and mass production possibilities to permit manufacture in such quantities that the enemy could be overwhelmed by sheer numerical superiority; and this thought is strengthened when the airplane is examined with a view to its production possibilities.

In this respect, the Me-110's basic structure has apparently been simplified to eliminate complicated assemblies and parts, and to have achieved production economy by loosening up manufacturing limits as much as possible. For instance, the close dimensional limits required for interchangeability of wing fillets have been eliminated by piercing large attaching holes in the fillet itself, and using attaching strips to clamp them in place against the fuselage and wing panel.

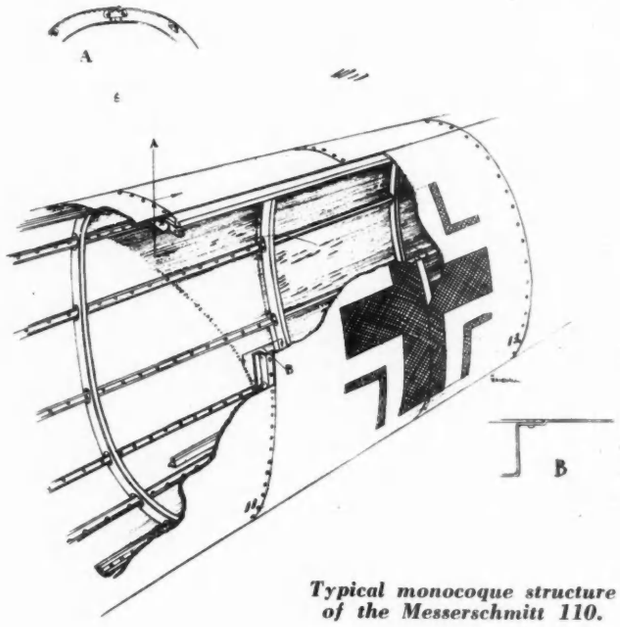
From this, and similar structural design features, it may be assumed that the Messerschmitt-produced parts fall considerably short of the manufacturing accuracy required of American airplanes; but are made completely interchangeable through the use of various compensating design features. However, the general design and construction of S9CK compare favorably with the best of American produced airplanes.

Getting back to the actual construction of the Me-110, we find a fairly large airplane for the fighter class—being twin-engine, three-place, low-wing monoplane of high quality all-metal construction. Its overall span is 53 ft. 5 in., overall length is 40 ft. 6 in., with a wing area of 414 sq. ft. The gross weight, loaded, is about 15,000 lbs., and the high speed at 19,000 ft. is estimated at 365 m.p.h.

Wing Construction

The all-metal wing is of the monospar type, composed of two detachable panels, with removable wing tips. The basic construction consists of an I-beam, located at about 40 per cent of the chord, and comprising a shear plate riveted to aluminum-alloy angle spar caps, with hat-section vertical stiffeners, Z-section stamped ribs spaced about ten inches, span-wise hat-section stringers, and flush-riveted, smooth skin. The rear beam is conspicuous by its complete absence, with aileron and flap loads being transferred directly to the ribs.

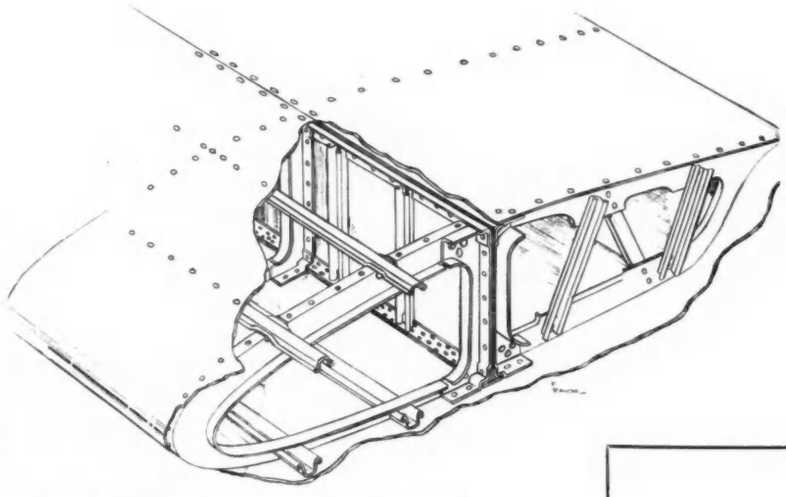
Each wing panel is connected to the fuselage by a four-point attachment between the wing inboard bulkhead and the fuselage structure. The wing spar attachment points comprise a large diameter bolt pass-



Typical monocoque structure of the Messerschmitt 110.

NOTE: Dimensions, areas, weights and performance given herein have been taken from sources believed to be authentic, but may not be entirely correct.

the Messerschmitt 110



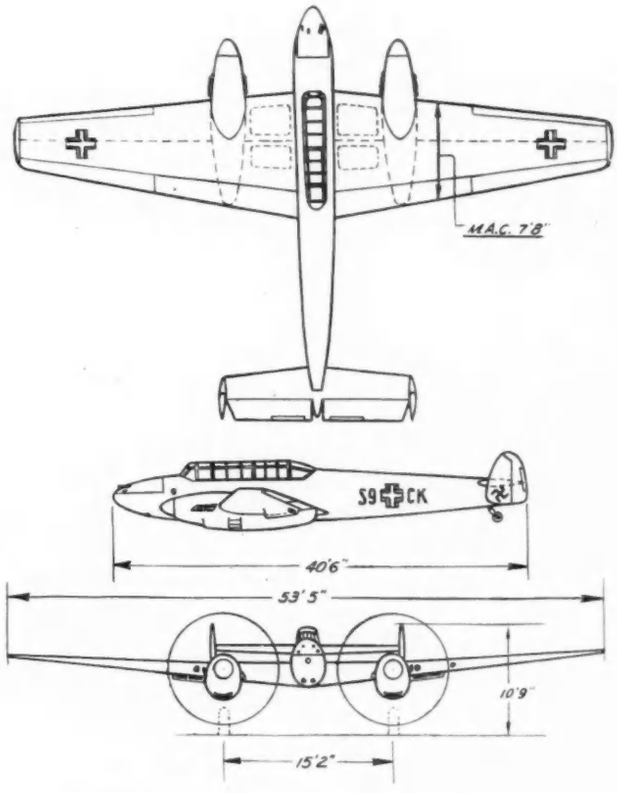
Details of the Messerschmitt wing structure.

a cast magnesium nose piece of small section being attached with flush screws. The basic construction of the horizontal stabilizer can best be understood by visualizing a conventional structure of front and rear channel-section beams, pressed ribs, and cover sheets being sliced along the chord line to give an upper and a lower half; with the cut edges of the ribs and beams in each half then being provided with flanges, so that each becomes a Z-section. These halves are placed together, and the entire outside

ing through a clevis fitting, to connect the bottom of the spar, and a large stud, extending through a boss riveted to a cross tube within the fuselage, to connect the top of the spar. Primary torsion loads are taken out by a clevis fitting connecting the nose section of the monospar to the fuselage; while a second clevis joint, near the aft end of the wing, provides for carrying the aileron and flap torsion loads into the fuselage.

Ailerons and wing flaps are both constructed in the same manner and with a conventional beam, metal nose skin, riveted ribs, and cloth covering. The wing flaps are similar to our N.A.C.A. slotted type, extending from fuselage to aileron, and are interconnected with the adjustable stabilizer to trim automatically the airplane for landing. Power operation is provided by a hydraulic actuating cylinder. Automatic wing slots fitted to the wing leading edge further reduce the landing speed.

The all-metal horizontal stabilizer is formed from symmetrical halves, riveted and bolted together in simple fashion, with

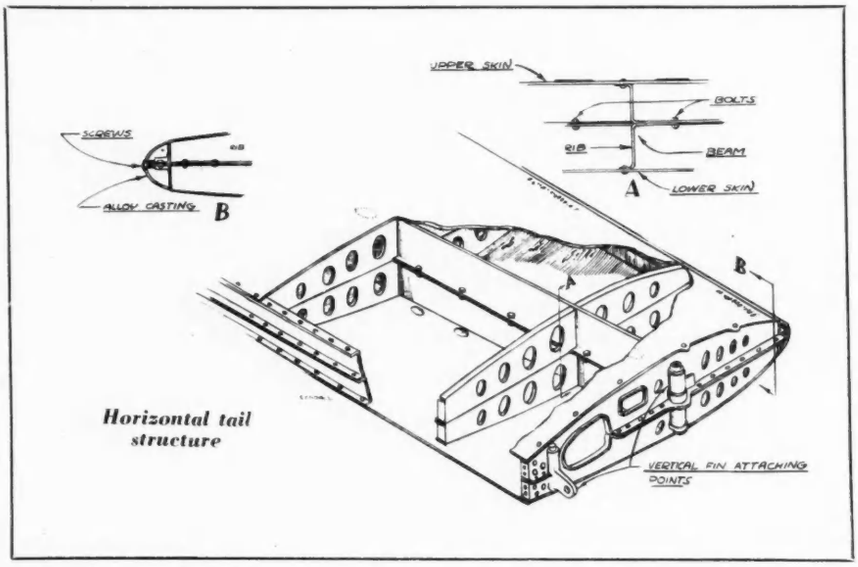


Plan and elevation views of the Messerschmitt.

AERO DESIGN

edge riveted through the lip formed by the mating flanges of the Z-sections; with the flanges of the front, or main, spar being joined by bolts inserted through holes pierced in the upper and lower skin sheets. As a final manufacturing operation, small cloth patches are doped over the bolt holes. The vertical stabilizer construction is similar.

The empennage movable surfaces are conventional beam and rib construction with cloth covering, and a controllable, servo-acting tab is provided on each. The flush-type covering is sewn to cloth tacking strips riveted to the side of the ribs.



Horizontal tail structure

Semi-Monocoque Fuselage

The semi-monocoque fuselage structure is built in two symmetrical halves, each consisting of curved aluminum-alloy sheets with the ends of each alternate sheet being formed with integral Z-section bulkhead rings, and flush riveted to form a structure that is noticeably clear of internal structural cross-members. The two halves are riveted together along the upper and lower centerlines to form the complete structure. Reinforcing longerons are provided in the upper and lower portions of the structure at the cockpit opening, and hat-section stringers extend the length of the fuselage. A noticeably small variety of sheet gages and section forms are used; with heavy gage skin being relied upon for strength in order to avoid production complications arising from a variety of internal strengthening members.

The fuselage is of comparatively small cross-section, to the extent that the pilot's cockpit is noticeably cramped. The cockpit is really one long opening, rather than individual cockpits for each crew member, and is covered by an enclosure of the canopy or "greenhouse" type. The enclosure over the pilot is arranged to swing the top aft and up, while the side panels fold down; with the aft portion of the enclosure in the form of a hood arranged to tilt upward and slide forward to provide for gun operation. The overturn structure on U. S. military craft is entirely absent.

Each leg of the fully retractable main landing gear comprises a pivoted cantilever strut, arranged to swing aftward and up into retracted position within the engine nacelle fairing. Fairing doors completely enclose the wheel in retracted position. Operation is accomplished by a hydraulic actuating cylinder. Contrary to American design practice, the landing gear is not provided with locks for either extended or retracted position, with hydraulic fluid pressure being relied upon to hold the gear in position. A compressed air system provides for emergency actuation, with air being stored under extreme pressure in a small cylinder.

A simple cantilever strut, rigidly fixed to the fuselage aft-bulkhead, provides for the non-retractable tail wheel. The tail wheel is non-steerable, and is probably provided with a centering cam within the shock-absorber cylinder.

Conventional stick and rudder-pedal flight controls are fitted in the front cockpit only, with individual toe action provided for the hydraulic wheel brakes.

Leak-Resistance Fuel Tanks

Four leak-resistant fuel tanks are provided, one in front of and one behind the wing spar, inboard of each engine. Space provisions outboard of each engine provide for two additional tanks. The total normal fuel capacity with four tanks is about 340 gallons; with a maximum capacity, using six tanks, of about 480 gallons. A detail examination of the leak-resistant fuel tanks has not been made, but they appear to be of typical German construction, employing a riveted fibre tank, protected with a thick outer casing in the form of a rubber "sandwich" comprising several layers of pure rubber held between outer and inner layers of tough, vulcanized rubber. An interesting feature is the supporting frame, composed almost entirely of molded plastic parts. This is obviously to protect the tank from jagged metal fragments, should the frame be pierced by a bullet.

Extensive use is made of shielded wiring, with conduit used only where mechanically necessary for protection. Connector block and plugs are extensively used throughout the airplane and fuses have apparently been entirely replaced by circuit breakers. Attachment of wiring to the structure is by narrow metal bands joined by a crimp, rather than by the clamps customary with American aircraft.

A bewildering array of radio equipment is installed, apparently comprising long and short wave transmitters and receivers, radio compass, and blind landing equipment.

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Demand for More Bombers Revises Production Plans

Possibility That Ford May Build Complete B-24 Ships at Ypsilanti; Olds and Pontiac Share New Gun Contracts

Upward revision of the U. S. Army's bomber production program to 500 four-engined planes per month will find the Ford Motor Co. supplying complete airframes for 270 Consolidated B-24 planes per month, according to the statement of Charles E. Sorensen, Ford production manager. This production will be in a new $18,000,000 plant now under construction near Ypsilanti, Mich. Plans call for Ford to ship the subassemblies—wings, fuselages, ailerons, tailpieces and landing gears—to final assembly plants at Fort Worth, Tex., and Tulsa, Okla., but there is a possibility that under the accelerated program Ford may assemble the complete planes at Ypsilanti. Original plans by the Automotive Committee for Air Defense called for only 100 B-24 planes per month.

One hundred and fifty Ford engineers are now at the Consolidated Aircraft Corp. plant at San Diego, Cal., studying bomber production methods. Current heavy bomber production is estimated at 50 per month split between Consolidated B-24's and Boeing B-17's.

$12,975,000 Gun Contract to Olds

Olds Motor Works Division at Lansing has been awarded a contract for $12,975,000 for the manufacture of 20-m.m. Hispano-Suiza aircraft cannon. The operation will involve purchase of 500 pieces of machine equipment, valued at $2,750,000, dies and fixtures costing $750,000 and $250,000 for building rearrangement. Two hundred thousand sq. ft. of floor space has been made available in the crankshaft building, 156 machines being moved to the former piston department in the 8-cylinder engine building. Out of 190 parts in the gun, which fires up to 700 rounds per minute, Oldsmobile plans to subcontract all but 33.

Pontiac Motor Division's government order for naval ordnance totals $17,306,000, and is for the manufacture of the Oerlikon anti-aircraft gun, a Swiss weapon designed for use on shipboard as a protection against dive bombers. It can fire 400 explosive shells per minute. Pontiac is utilizing 325,000 sq. ft. of space in Plant 4 for this work.

Indicative of the British need for tanks is an order for more than 1000 Cadillac 150 hp. engines placed with that division of GM to be used by the Australian government. It is believed that three of these engines will be hooked together to power Australian-made tanks. Cadillac recently completed tests in which a V-8 engine was tilted to a 35-degree angle such as under tank use. At the maximum angle, only a slight reduction in the normal hp. was evident. Changes in the carburetor float and the seals were made to prevent leakage, and it was necessary to lower the oil pump and install a deeper oil pan.

Recent national defense orders include $4,289,613 to Chevrolet for 1½-ton cargo trucks; $1,149,987 to AC Spark Plug Division of GM for aviation spark plugs; $1,419,004 to Champion Spark Plug Co., Toledo, for aviation spark plugs; $4,286,506 to Fruehauf Trailer Co., Kansas City, for trailers; $822,510 to Goodyear Tire & Rubber Co. for wheel and brake assemblies, and $1,653,833 for airplane wings; $112,499 to Hayes Industries, Inc., Jackson, for wheel and brake assemblies.

Several plant expansion programs also have been approved, including $1,691,200 to Chrysler Corp. for machinery and tools to make Martin B-26 bomber sub-assemblies; $2,070,000 to Willys-Overland Motors, Inc., to rehabilitate buildings and provide production equipment for aluminum airplane forgings. Ex-Cell-O Corp., Detroit, has been granted an order for $3,506,657 to replace an original order for $1,689,678 for expansion costs in the manufacture of small machined aircraft parts.

European Auto Makers Pool Data

Automobile manufacturers of Germany, France and Italy will collaborate in the future through a joint committee to further the expansion of the European automobile industry, according to announcement from Vichy, France. It is stated that the tripartite accord will not be in the form of a cartel, but rather a pooling of engineering and manufacturing data, and consideration of the most advantageous commercial policy.

The committee is to be composed of five representatives from each country and will meet in Berlin, Paris and Rome. A provisional committee meeting is scheduled for June 5 at Berlin.

Inspecting B-24 Bomber

A Consolidated B-24 Bomber was flown recently from Wright Field to Ford Airport at Dearborn for inspection by Ford engineers. Huge subassemblies for this type plane are to be built by Ford at a new plant near Ypsilanti, Mich. The B-24 weighs 21 tons, is powered by four 1200 hp. Pratt & Whitney engines, has a cruising radius of 3000 miles, a bomb load capacity of four tons and requires 14,000 parts exclusive of engines.

NEWS

GM Mediation Efforts Face UAW-CIO Deadline

Negotiations Center on Closed Shop and Wage Increases; Ford Election Scheduled May 21; Other Strikes Threaten

While negotiations between high officials of General Motors Corp. and the UAW-CIO continued before the National Defense Mediation Board in Washington D. C., in an effort to avert the threatened strike in 61 General Motors plants, the National GM Council of the UAW-CIO meeting in Detroit, May 11, set May 15 as the strike deadline. Hearings began May 1 before a special panel of the board after the dispute was certified by Secretary of Labor Perkins.

C. E. Wilson, president, and B. D. Kunkle, vice-president, headed the GM negotiators, while Philip Murray, president of the CIO; R. J. Thomas president of the UAW-CIO, and Walter Reuther, head of the union's GM Dept., were among a large group of union negotiators. Negotiations apparently were stalled on the questions of the closed shop and wage increases.

On the union shop issue, the union asks that all employes be required to join the UAW-CIO within 30 days of employment. The union is asking a blanket 10-cent-an-hour wage increase for all employes, pointing to the GM net profit of $195,715,000 last year. GM has countered with an offer of wage increases from two to five cents an hour that would cost the corporation $15,000,000 per year, while the union demands would cost $40 000,000. Any wage increase is to be retroactive to April 28.

On the matter of wages, Wilson said, "The problem is not whether a further wage increase is justifiable but how much should GM pay to avoid a strike and how much it is fair to ask GM to increase its labor costs above the labor costs of other heavy goods industries when we will all be working on national defense production on a competitive basis."

GM's average wage in February for all men in car and body plants was $1.05½ an hour and its average for all U. S. divisions, including non-automotive, was 97.9 cents per hour. Wilson estimated that a strike would cost GM between one and two million dollars per day, while the daily wage loss would be $1,600,000.

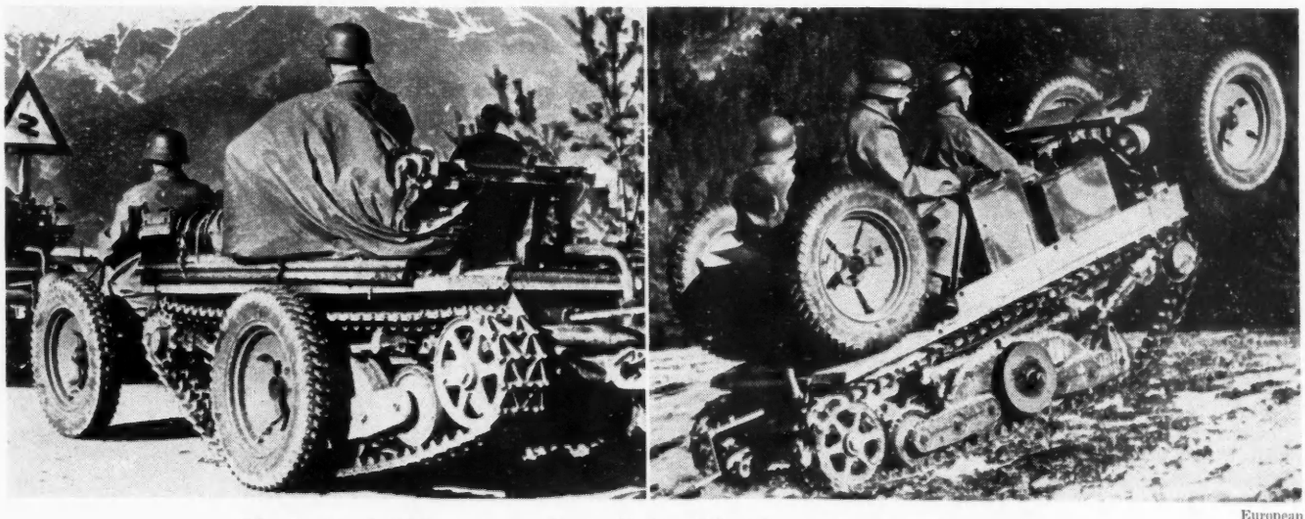
Union Claims Vary at Rouge

May 21 has been set as the date for an NLRB election to determine a collective bargaining agent for 80,372 eligible employes of the Ford Motor Co. at the huge Rouge plant in Dearborn. The same day, 2943 Lincoln plant workers also will vote, while 271 Ford Rouge patternmakers will go to the polls in another election. The UAW-CIO and federal locals of the AFL are chief opponents in the Rouge and Lincoln elections. The UAW-CIO claims it will poll 90 per cent of the vote, while the AFL asserts it has signed up 21,000 members in three weeks. Some altercations have occurred in the Rouge plant between the rival unions since the recent strike and detachments of Michigan State police have been on duty to maintain order. The UAW-CIO also has petitioned for an election at the Ford Highland Park plant, which employs 3000 men.

A seven-day strike of 2300 workers at the Packard Electrical Division of GM at Warren, Ohio, ended May 9 after a dispute over dismissal of 156 workers and pay rates.

A strike of 3200 workers at three Detroit plants of the Ex-Cell-O Corp. was certified to the National Defense Mediation Board May 8, two days after it began. The company, which manufactures small machined aircraft parts and tools, has more than $16,000,000 in defense orders. It makes 35 parts for the Allison engine. Employes voted down a 5-cent-an-hr. wage increase May 4 after the union's negotiating committee accepted the increases retroactive to April 1. The original demand had been for a 10-cent-an-hr. raise. Negotiations began March 24 and a strike notice was filed April 21, but Gov. Murray D. VanWagoner appointed a special three-man mediation commission which helped work out the settlement that was rejected by the members of the UAW-CIO on May 4. Average annual earnings of the company's workers last year were $2,690, while the average for the first quarter of 1941 would up the annual rate to $2,800. The average raise rejected by the workers would amount to $137.80 annually.

The UAW-CIO filed notice with the state May 7 of intent to strike at the Hudson Motor Car Co., Detroit. A mass meeting of Hudson workers authorized a strike to begin May 13. The union asks a 15-cent-an-hr. wage increase for 8500 workers. The company has $10,000,000 in defense subcontracts for airplane parts.



European

Motorized "Mountain Goats" for Blitzkrieging in Mountains

When the Nazi mechanized divisions swept through Yugoslavia and Greece, the quick advance in the rough Balkan mountains is explained in a large measure by the use of new mountain climbing tanks, also called motorized "mountain goats." They operated in close cooperation with the heavier Panzer divisions to carry out the necessary mopping up operations on the flank.

This machine seems to be a combination of a "blitz buggy" and a light armored tractor. Weighing about four tons and carrying a crew of two or three, it is understood to be armed with 47-mm. cannon and two 20-mm. machine guns in a light armored turret.

For climbing steep mountain slopes, it uses its caterpillar treads. The two rear wheels are mounted on carriers above the frame and the retractable front end mechanism, including axle, transverse spring and wheels, is hoisted into the air by means of a worm screw drive. When road travel becomes feasible, the rear of the machine is jacked up four or five inches, the rear wheels removed from their carriers and attached to the axle shafts. The front wheels then are lowered to take the front end weight.

On the rubber-tired wheels these machines are understood to be capable of 50 m.p.h. With caterpillar treads, top speed is 25 m.p.h.

A threatened strike of 7000 workers at the Bendix Products Division of Bendix Aviation Corp., South Bend, Ind., was certified May 7 to the National Defense Mediation Board. Hearings were due to begin May 12 in Washington. The plant holds $13,905,000 in defense airplane contracts.

The UAW-CIO filed notice May 9 of intent to strike at the Murray Corp. of America which also employs 7000 men and has large warplane subcontracts.

Recent wage increases in the automotive industry include 10 cents an hr. to 14,000 employes in three plants of Timken Roller Bearing Co., totaling $2,500,000 per year; 6 to 13 cents an hr. at the Gemmer Mfg. Co., Detroit; 5 cents an hr. for 5800 employes of Thompson Products, Inc., in three plants, and a bonus of 40 hr. pay to all employes of the Stewart-Warner Corp.

du Pont to Build Huge Neoprene Plant

E. I. du Pont de Nemours, Inc., is starting construction on a neoprene plant at Louisville, Ky., which, with a capacity of 10,000 long tons a year, is expected to exceed the present combined total U. S. production of all synthetic rubbers including neoprene. Production of this product has already reached 6000 tons a year at the company's Deepwater, N. J., plant and this figure will be raised to 9000 tons by the end of the year according to company officials.

CALENDAR

Conventions and Meetings

Western Metal Exposition and Congress, Los Angeles .....May 19-23
Aluminum Assoc. (Summer Mtg.) Cincinnati .....May 20
American Management Assoc., New York City .....May 21-22
American Iron & Steel Institute, New York .....May 22
American Battery Manufacturers Assoc., Detroit .....May 22-23
Automotive Engine Rebuilders Assoc., Pittsburgh .....May 22-24
Society of Automotive Engineers, Summer Meeting, White Sulphur Springs, W. Va. .....June 1-6
A.S.M.E. Oil & Gas Power Division, Kansas City (National Mtg.).June 11-14
Eastern Photoelasticity Conference, Cambridge, Mass. .....June 12-14
Amer. Society Mech. Engineers, Kansas City, Mo. .....June 16-19
American Society for Testing Materials, Annual Meeting, Chicago....June 23-27
Natl. Petroleum Assoc., Atlantic City, Sept. 17-19
Society of Automotive Engineers, National Tractor Meeting, Milwaukee, Sept. 25-26
Natl. Lubricating Grease Inst., Chicago, Sept. 29-30
Natl. Safety Council, Chicago....Oct. 6-10
American Welding Society, Philadelphia, Oct. 19-24
American Society for Metals, Philadelphia .....Oct. 20-24
Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles .....Oct. 30-Nov. 1

Shows

Automobile Accessories Association Show, Chicago .....Aug. 4-7

92 Minutes to Nowhere

Igor I. Sikorsky, plane designer, hovered near Bridgeport, Conn., for 1 hr. and 32½ min. on May 6 to set a new world's record for the helicopter-plane. It can move up or down vertically as well as fly forward, backward or sideways. Power for the 28-ft. main propeller and three auxiliary propellers is from a 90-hp. Franklin engine.

Truck Transportation Is Vital to Defense

During the 12 months preceding July 31, motor truck manufacturers of this country will have produced more than 137,000 military vehicles for the U. S. Army, according to a report, "Essential Defense Uses of Motor Truck," which has been submitted to Director General Knudsen, Office of Production Management, by the Motor Truck Committee of the Automobile Manufacturers Association. These manufacturers also are engaged in making tanks and other armament for the Army and Navy.

The committee emphasizes the present role of truck transportation in national defense as a more integral part of the national economy than in 1918. Today truck registrations total 4,650,000 units, nearly nine times greater than in 1918. From information available, the report states, transportation agencies are running close to capacity, that pinches have been felt in some quarters and with the intensification of the defense program, this condition is bound to increase. About 22 per cent of outgoing tonnage of plants producing defense material is moved by trucks and a 10 per cent increase is anticipated within the next six months.

More Metals, Diesel Engines on Priority

Fifteen classes of metals and a number of finished products, including all types of Diesel engines, have been added to the priorities critical list of the Office of Production Management. The added metals consist of antimony, cadmium, chromium, cobalt, copper, ferrous alloys (all types), iridium, iron and steel products (including rolled, drawn, forgings and castings), pig iron (including alloy steels), lead, manganese or spiegeleisen, mercury, molybdenum, non-ferrous alloys (all types) and steel (semi-finished. finished and fabricated).

Besides Diesel engines, among the other finished products added to the priorities list are electric motors (other than fractional horsepower), internal combustion engines and steam engines for ship propulsion, portable and power driven tools, wire for electrical instruments and welding rods.

For the purpose of preventing inventories from reaching "unnecessary levels," Director of Priorities Stettinius has organized an inventory control system, which is extended to all metals on the priorities critical list, and in addition secondary materials, or scrap, containing any of the listed metals. The new inventory control requires suppliers to reduce shipments to overstocked customers. Lawrence J. Martin, on leave of absence from his post as assistant to the president of Thomas A. Edison Inc., Orange, N. J., has joined the OPM staff to take charge of the inventory control system.

New Wright Engine Plant Now Starting Production

Near Cincinnati, end of last month, Wright Aeronautical Corp. began the production of 14-cylinder Wright Cyclone engines in the world's largest single-story industrial plant. Under its single roof are 50 acres of industrial machinery—2,120,000 sq. ft. of floor space. Topping its expansive list of tools are two Greenlee machines, each 152 ft. long, and each with 59 separate stations for the finishing of cylinder heads at a rate of one every two minutes.

European

Luftwaffe's Latest Fighter

Two 1375 hp. Daimler-Benz engines power this new Focke-Wulf 189, designed as a successor to the Luftwaffe's famous Messerschmitt 110. Speed is reported better than 400 m.p.h. and for armament it carries four cannon and four .50-cal. machine guns.

Increasing Amount of Steel Being Diverted to Defense

Restrictions Result in Supplying Civilian Needs; Temporary Suspension of Operations at Few Plants Due to Shortages

By W. C. Hirsch

Progressive adjustment of the steel market to the defense program's exigencies brings more and more restrictions in the supplying of civilian needs to attain immediate results, and more and more plans for increasing output through adding to capacity and the stepping up of production. The problem of preventing prices from getting out of control, not so long ago the cause of most headaches in the National Defense Advisory Commission's offices, is no longer the chief source of worry.

By granting to a small producer of steel bars an exception from ceiling prices, because compliance with these would have compelled the company to operate at a loss, the Office of Price Administration proved its willingness to give consideration to pleas for reviews in special cases, when the underlying facts justify it. Whether this will, as some think, lead to the setting up of a dual price list, one for the large producers and another for the smaller mills, is by no means certain. But inventory control, subject to periodical check-ups and audits which has been ordered by the Office of Production Management, has implications of the greatest importance to consumers. The object is to prevent the building up of excessive inventories by consumers as well as producers.

Such inventory control may also lead to modifications in the system followed by producers in allocating primary steel to the rolling of the different finished descriptions. Under conditions, such as those now prevailing, it is the tonnage of primary steel available for rolling rather than rolling mill capacity that governs output of sheets and strip. If anything like dependable inventory control can be attained, it is likely, therefore, to be the guide in the distribution of raw steel to the different finishing units.

Steel production has almost recovered what ground it lost as the result of the gaps caused by the shortage in coal resulting from the recent miners' strike. In the second week of May the American Iron & Steel Institute estimated mills operating at 96.8 per cent of ingot capacity. Fresh commitments for steel bars come chiefly from shell makers, with automobile manufacturers and parts makers continuing to inquire actively for alloy bars. A few plants, depending upon a continuous supply of sheets and strip steel for their operations, are reported to have had to suspend work for a day or two because of non-arrival of urgently needed tonnages.

The president of one of the largest copper companies has come out in support of the Government's price policy, declaring that it would be absurd to raise the price of 85,000 tons of copper in order to obtain an additional thousand tons per month production. If the price were 20 cents a pound, which it would have to be, to bring some of the high cost producers back into the industry, the large producers could not have added even a single pound more to the output, as all are operating at capacity. The aftermath of a 20-cent copper price, it is contended, would be disastrous for the industry. The market continues at 12 @ 12½ cents for spot electrolytic.

It is learned that the Government has not been able to buy any tin for its stockpile at the fixed buying price of 50 cents, c.i.f. New York, in three months. Retrenchment in the consumption of tin has become imperative, and the cooperation of all consumers to that end is being sought. The market for spot Straits holds at around 52 cents.

New Thin Hex Model By Elastic Stop Nut

For use on shear bolts where a high degree of the stress is lateral, and for general application to light and medium stress fastenings, an improved line of thin hex nuts is announced by Elastic Stop Nut Corporation, 2332 Vauxhall Road, Union, N. J. These self-locking nuts have approximately 40 per cent of the strength of standard-height hex nuts and offer savings in space requirements, weight, and cost.

Protex-Plug Aids In Engine Storing

A new device known as the Protex-Plug and designed to prevent corrosion in the cylinders of stored aircraft engines has been introduced by Chandler Evans Corp., South Meriden, Conn. Built to the approximate dimension of a standard spark plug, the unit contains a charge of Silica Gel which absorbs moisture within the cylinder. Obviously all openings must be closed to get the benefit of the Silica Gel action. Used in place of the standard plug it not only seals the opening and absorbs moisture but also provides a terminal for ignition wire.

New Crosley Models

The Crosley Corp. has introduced new models of the Crosley automobile. Virtually unchanged in outward appearance the new models feature greater acceleration, constant mesh starter, refined oiling system, heavier crankshaft and camshaft, and self-equalized brakes. Offered in eight body styles, the prices, f.o.b. Richmond, Ind., are as follows:

Coupe, $325; standard sedan, $375; convertible sedan, $385; parkway delivery, $399; pick-up delivery, $399; covered wagon, $425; panel delivery. $449, and station wagon, $479.

42 Entries Tangle for Spots at Indianapolis

Two four-wheel-drive rear-engine racers designed by Harry Miller are among the 42 entries for the 500-mile Memorial Day Race at the Indianapolis Speedway. Of these, 33 will be picked in final eliminations to start the event —billed this year as the only major automobile race in the world.

Among familiar faces behind the wheels will be Wilbur Shaw, three-time winner; Rex Mays, last year's runner-up; Mauri Rose, Kelly Petillo, Joe Thorne, Chet Miller and Cliff Bergere. Two Frenchmen from Vichy, Rene LeBegue and Jean Trevaux are hoping to be there, ship priorities and blockade tactics permitting.

In addition to the four-wheel-drives the mechanical line-up includes seven front-wheel-drives, and 12 supercharged engines. A new engine in Ralph Hepburn's car features a fuel cooling system and the one 16-cylinder entry (Frank Lockhart engine) is said to have been revitalized.

Price Administrator Urges 20% Car Tax

An excise tax on automobiles of 20 per cent or more, with coverage extended to used cars, has been recommended to the House Ways and Means Committee by Leon Henderson, White House adviser and head of the powerful Office of Price Administration and Civilian Supply. Mr. Henderson told the committee that a straight tax of $100 on every car sold next year would not prevent the sale of all the cars to be turned out under curtailed production schedules.

The proposed 20 per cent tax on automobiles was endorsed by Marriner S. Eccles, head of the Federal Reserve System. Under the Treasury Department's recommended tax revision program the present 3½ per cent tax on automobiles would be increased to 7 per cent.

Acme

Uncle Sam's Latest Fighter

Capable of over 450 m.p.h., the warplane in the foreground is one of the first Lockheed P-38 interceptors to roll off the assembly line at Burbank, Calif. It is powered by two Allison engines. The other planes in the field are Hudson bombers waiting to be flown to England.

Passenger Car and Truck Production

(U. S. and Canada)

	March 1941	February 1941	March 1940	THREE MONTHS 1941	THREE MONTHS 1940	Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	398,882	385,676	341,634	1,186,357	1,014,944	+16.8
Foreign Market—U.S.	11,376	8,807	11,288	29,642	38,631	−23.3
Canada	12,093	10,647	12,025	34,730	37,383	− 7.0
Total	422,351	405,130	364,947	1,250,729	1,090,958	+14.8
Trucks—U. S. and Canada						
Domestic Market—U. S.	86,362	78,580	58,650	242,624	167,656	+45.0
Foreign Market—U.S.	11,248	12,460	12,048	35,699	38,700	− 7.7
Canada	13,951	13,063	4,587	38,219	14,635	+161.5
Total	111,561	104,103	75,285	316,542	220,991	+43.3
Total—Domestic Market—U. S.	485,244	464,256	400,284	1,428,981	1,182,600	+20.8
Total—Foreign Market—U. S.	22,624	21,267	23,336	65,341	77,331	−15.5
Total—Canada	26,044	23,710	16,612	72,949	52,018	+40.0
Total—Cars and Trucks—U. S. and Canada	533,912	509,233	440,232	1,567,271	1,311,949	+19.3

New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	FEBRUARY				TWO MONTHS				FEBRUARY				TWO MONTHS			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940
Chevrolet, Ford and Plymouth	162,788	122,326	54.22	54.47	321,246	264,082	53.61	54.47	$132,235,000	$93,500,000	47.98	48.11	$261,022,000	$201,800,000	47.30	48.01
Others under $1,000	54,520	72,255	18.16	32.17	109,291	155,540	18.24	32.09	50,235,000	65,400,000	18.27	33.65	011,008,000	141,000,000	18.30	33.55
$1,001 to $1,500	77,661	28,317	25.86	12.61	157,435	61,114	26.27	12.61	84,003,000	32,000,000	30.48	16.47	170,352,000	69,300,000	30.87	16.49
$1,501 to $2,000	4,381	1,044	1.46	.46	9,097	2,493	1.52	.51	6,874,000	1,800,000	2.49	.93	1,428,000	4,300,000	2.59	1.02
$2,001 to $3,000	900	657	.30	.29	2,158	1,556	.36	.32	2,145,000	1,600,000	.78	.82	5,174,000	3,800,000	.94	.90
$3,001 and Over		8				24				40,000		.02		120,000		.03
Total	300,250	224,607	100.00	100.00	599,227	484,809	100.00	100.00	$275,643,000	$194,340,000	100.00	100.00	$551,844,000	$420,320,000	100.00	100.00
Miscellaneous	216	18			418	32										
Total	300,466	224,625			599,645	494,841										

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

Evidences of renewed expansion of business activity reflect especially the resumption of bituminous coal mining. The seasonally adjusted index of The New York *Times* for the week ended April 26 advanced to 120.4 per cent of the estimated normal from 118.6 for the preceding week, as against 100.1 a year ago. The unadjusted index of *The Journal of Commerce* for the same period was 110.4 per cent of the 1927-29 average, as compared with 109.9 for the week before.

Department store sales during the week ended April 26, according to the Federal Reserve compilation, exceeded by 17 per cent the total for the corresponding week last year. Sales for the 4-week period ended on that date totaled 23 per cent more than the comparable amount in 1940.

Bank debits to deposit accounts, except inter-bank accounts, in leading cities during the 13-week period ended April 30 were 15 per cent above the total a year earlier.

The movement of railway freight increased further during the week ended April 26. Loadings totaled 721,702 cars, 1.8 per cent more than in the week before and 11.9 per cent above the comparable number last year.

Electric power production during the week ended May 3 declined less than seasonally to a level 14.6 per cent above that a year ago. Gain of the preceding week was 14.7 per cent.

Business failures during the week ended May 1 numbered 272, as compared with a like number for the week before and 292 a year ago, according to the Dun & Bradstreet report.

Crude oil production in the week ended May 3 averaged 3,507,100 barrels daily, 219,750 barrels less than the average for the preceding week and 202,200 barrels below the currently required output as computed by the Bureau of Mines.

Average daily output of bituminous coal during the week ended April 26 was only 267,000 tons, as compared with 233,000 tons a week earlier and 1,307,000 tons a year ago.

Cotton mill activity advanced contra-seasonally in the same period. The New York *Times* adjusted index rose to 166.3 per cent of the estimated normal from 161.6 for the preceding week, as against 115.0 a year ago.

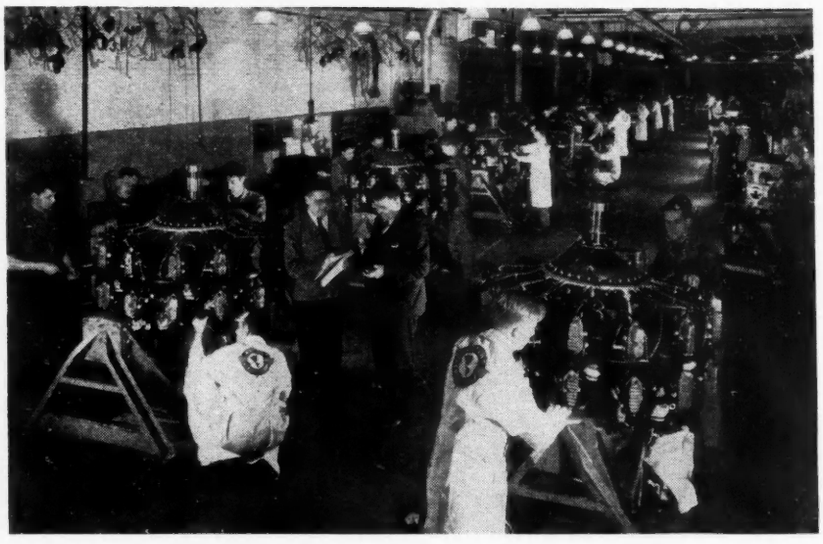
Professor Fisher's index of wholesale commodity prices for the week ended May 2 was unchanged at 89.9 per cent of the 1926 average, after successive advances from 86.0 at the beginning of March.

Member bank reserve balances increased $18,000,000 in the week ended April 30, and estimated excess reserves rose $10,000,000 to a total of $5,770,000,000. Business loans of the reporting members increased $23,000,000 to exceed by $1,123,000,000 on that date the comparable amount last year.

Ford of Canada Holds Huge War Contracts

Ford Motor Co. of Canada, Ltd., holds contracts for approximately 50,000 motorized vehicles for military use, of which 10,000 are for Canada and the remainder for other parts of the British Empire. These include ambulances, anti-tank gun tractors, machine gun carriers and ammunition trucks. A $700,000 plant addition is under construction at Windsor, Ont., in which machine gun carriers will be made.

Employment is at an all-time peak of 13,236 men, according to Wallace R. Campbell, president. Retail sales totaled 97,360 units last year, a gain of 56 per cent over the previous year. Dollar volume in 1940 reached a new high of more than $86,000,000.



Engines for Defense

While the five Wright Aeronautical Corp. plants at Paterson, N. J., were already setting new records in engine production (1,430,000 hp. in March) the new 50-acre plant at Cincinnati got under way end of last month. Photo shows section of final assembly line at Paterson.

Jackson Hints at Anti-Trust Law Moratorium

Anti-trust law policy for the duration of the defense emergency, covering the course to be followed by the Justice Department in the face of the increasingly large number of industry meetings, has been set forth by Attorney General Robert H. Jackson. The interpretation suggested to some observers that the OPM may be planning to recommend the establishment of industry committees through which defense work could be expedited.

In a letter to OPM General Counsel John Lord O'Brian, Mr. Jackson explained that his statement of policy was prompted by the likelihood of future allocation of orders, the curtailment of some types of production, the establishment of priorities, the pegging of prices and other practices which under normal circumstances would constitute violations of the anti-trust laws.

National Motor Boat Show Set for January, 1942

The 1942 national motor boat show in New York will be held Jan. 9-17, according to an announcement of the National Association of Engine and Boat Manufacturers. George W. Codrington, president of the Cleveland Diesel Engine Division of General Motors Corp., has been appointed chairman of the show committee, succeeding Charles A. Criqui, Sr., of Buffalo. There has been no interruption in the series of national motor boat shows ever since the first one was held in the old Madison Square Garden in 1905. Two new members have been appointed to the executive committee of the Association, viz., Addison F. Vars, president of the Sterling Engine Co. of Buffalo, and E. C. Hancock, general manager of Gar Wood Industries, Boat Division, Marysville, Mich.

Ford Sells Charlotte Branch

Ford Motor Co. has sold its branch building at Charlotte, N. C., to the U. S. Army for use as a Quartermaster Depot for the Southeastern States. The Ford organization will retain space in the building until other quarters in Charlotte can be obtained. The plant is on a 72 acre tract and includes a power house. Originally opened in 1914 as an assembly point, it has not been used for this purpose for the past seven years.

Steven D. Briggs

Steven D. Briggs, formerly an automotive export sales executive, died April 16 at Laguna Beach, Calif. He was 61 years old. Briggs was at one time foreign sales representaitve of the Hupp Motor Car Co. and later was European manager of the Chrysler Corp. for 10 years until his retirement in 1936.

MEN . . . . . .

Olds Motor Works has announced several changes in its defense plant personnel. **R. E. Griffen** is now in charge of all Olds' defense production; **H. J. Cupper** is assistant production manager; **K. C. Plasterer** is manufacturing manager, and **J. G. Hickman,** standards engineer. At the Forge plant, **C. B. Dakin** is plant manager; **Emil P. Rohrbach,** machine division superintendent; **Harry Howell,** forge division superintendent; **Joseph Hartman,** assistant superintendent and **John A. Thomann** production engineer. **John H. Alfes** is plant manager of the machine gun division; **Maynard T. Murray** is Alfes assisant; **John Coleman** production engineer, and **Phillip Monaghan,** methods engineer.

I. O. Nelson, formerly superintendent of final inspection, has been appointed chief inspector at the Olds Motor Works to succeed John S. Alfes. **Archibald A. Lathrop** is Nelson's assistant.

W. F. Anderson has been elected an assistant secretary of General Motors Corp.

Wilfred Sykes has been made president of Inland Steel Co., Chicago, succeeding **Philip D. Block,** who becomes chairman of the executive committee. **L. E. Block** is now chairman of the finance committee and **James H. Walsh** is vice-president in charge of steel works.

Wayman A. Smith, Jr., of Oldsmobile, has been transferred to Lansing and named office budget manager, succeeding **Arthur Sandberg,** now assistant to the divisional comptroller.

L. Clayton Hill has been promoted to the office of vice-president and general manager of Murray Corp. of America, Detroit.

E. W. Heinrich is now divisional export manager of the Buda Co., Harvey, Ill., with a territory extending from Mexico to the equator. **George H. Koons** has charge of exports to points south of the equator. **Dwight Richards** has been named chief engineer of Buda's Railroad Division.

O. F. Zahn, Jr., formerly with the diesel division of Ex-Cell-O Corp., Detroit, is now on the technical applications committee of the Shell Oil Co., Martinez, Calif., as research engineer.

Carl Stieger, Wisconsin industrialist, has been named a director of the Four Wheel Drive Auto Co., Clintonville, Wis.

H. S. Sherwood has been appointed sales manager of Lube-X Systems, Inc., Chicago.

John A. Graham, president of Purolator Products, Inc., Newark, N. J. (formerly Motor Improvements, Inc.), since 1925 has been elected honorary chairman of the board. He is succeeded as president by **Ralph R. Layte,** former vice-president.

Carl J. Andrae has been named assistant sales manager of the Replacement Division, Wilkening Mfg. Co. (Pedrick Piston Rings), Philadelphia.

Frank G. Sorensen, chairman of the executive committee, has been elected president of United Aircraft Products, Inc., succeeding **H. L. Bill,** who remains a director.

Cleeman Withers, formerly vice-president of the Sperry Corp., has been elected executive vice-president.

William C. Wood has resigned as vice-president and secretary-treasurer of Reo Motors, Inc., Lansing, Mich.

R. A. Lambeth, treasurer, has been elected a director of North American Aviation, Inc.

Lee J. Bornhofen, assistant manager of advertising service, has been named promotion manager of Goodyear Tire & Rubber Co., succeeding **Butler Doclittle,** who becomes sales manager of motor car and home supplies. **Robert E. Lee** has been named factory manager of Goodyear's plant at Jackson, Mich., while **E. D. Sheahan** becomes manager of Plant No. 2 in Akron.

John E. Johnson, of Muncie, Ind., has been elected a director of Borg-Warner Corp., succeeding the late **John Fletcher.**

William C. Gulick has been appointed manufacturers' sales representative for the B. F. Goodrich Co. in Detroit. He formerly was in the company's export sales division.

Acme

In Hitler's Arsenal

An improved German tank which, according to the German censor, was among the new combat vehicles and newly-developed weapons shown to members of the press during a recent tour of inspection.

Ralph S. Damon, former vice-president of American Airlines, Inc., has been elected president of Republic Aviation Corp., succeeding **W. Wallace Kellett,** who has been elevated to chairman of the board of directors. **Frederick G. Coburn, Lester Watson** and **Mr. Damon** have been elected members of the board of directors.

John Fiske, vice-president of Fiduciary Trust Co., New York, has been elected a director of Colgate-Larsen Aircraft Corp., Amityville, L. I.

Claude Snider has joined The Chek-Chart Corp., Chicago, as service manager in charge of typography, layout, cover design, and color work.

Glen T. Lampton has been named assistant engineer in charge of experimental engineering at the Hamilton Standard Propellers Division of United Aircraft Corp., East Hartford, Conn.

Paul Smith and **William Bryant,** members of Buick's manufacturing staff, have been granted leaves of absence to accept supervisory postions with North American Aviation, Inc., at its Inglewood, Cal., plant.

Charles B. Kaas, formerly of Standard Oil Development Co., has been made coordinator of performance and endurance tests on the road for Ethyl Gasoline Corp., New York.

A. H. Frauenthal has tendered his resignation as vice-president and general manager of Bantam Bearings Corp., South Bend, Ind., and will establish a new factory in Muskegon, Mich. As yet unnamed, the new plant will manufacture special roller and ball bearings and aircraft parts.

John D. Sullivan, chief chemist of Battelle Memorial Institute, Columbus, Ohio, has been elected chairman of the Electrothermic Division of the Electrochemical Society.

Monsanto Opens Large Plastic Materials Plant

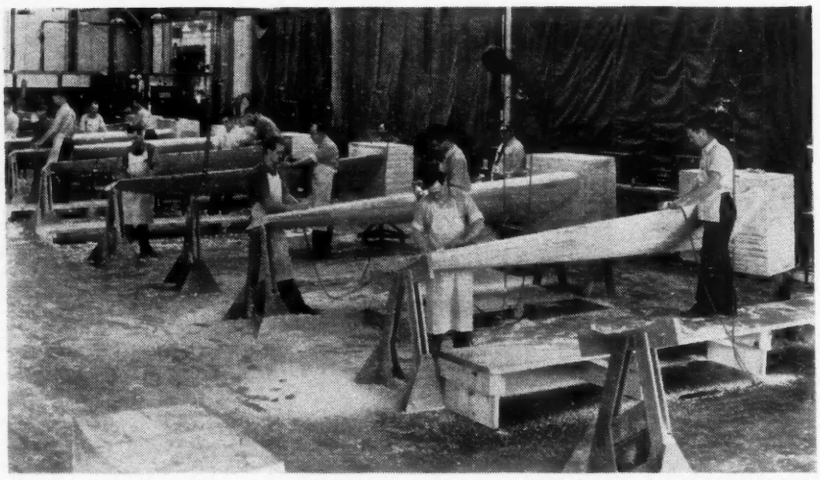
Monsanto Chemical Co.'s plastic division has opened a large new plant at Springfield, Mass., for the production of Resinox plastic molding materials. It is the largest single plant of its kind in the country. All operations are carried out in this plant from making the resin of phenol and formaldehyde in large steam jacketed vacuum kettles to

Full Floating Truck Seat

Hickman Pneumatic Seat Co., Inc., Eden, N. Y., announces an improved truck seat in two sizes and incorporating full floating and adjustable features to provide soft riding qualities. Four rubber bushed, one-piece, yoke type links guide and control seat movement, and are said to eliminate squeaks, wear and lubrication. These rubber-like connectors between frame and seat cushions are combined with sensitive supporting coil springs to produce a balanced full-floating seat action that permits the back and seat frame to move as a single unit. This uniform movement of the entire seat is claimed to minimize wear on clothing and upholstery fabric. The entire frame is built of heavy, arc-welded angle iron.

The cushions have bus type Atkinson cushion springs covered with burlap and

built up with several layers of cotton and topped with moss to insure long life seat shape. Heavy green imitation leather fabric is drawn and fastened to strong 3-ply wooden backs.



Official Photograph, U. S. Army Air Corps

41-Ton Fans in Wright Field Wind Tunnel

From 42 layers of spruce glued together and then pressed under a pressure of 2,000,000 lb. to produce a solid laminated block, each blade 13½ ft. long is formed for the huge fans to be used by the Army Air Corps in its Wright Field wind tunnel, which is described on page 511 in this issue of *Automotive Industries*. Each of the two fans, including its 16 blades and hub, weighs 41 tons. At top speed these fans drive about 11,000,000 cu. ft. per min. through the tunnel. The blades are taking shape in this part of the production line.

Americans in Argentina Form Export Company

Representatives of ten U. S. companies in Argentina, including General Motors, Ford and Chrysler, have formed an export corporation to develop the sale of certain Argentine products in the U. S. The object of the organization, to be known as the Argentine Trade Development Corp., is to promote the sale of Argentine goods in the U. S. for the purpose of raising dollar exchange which will permit greater export of American products to Argentina.

Last year Argentina was the best automotive market in South America, buying 10,804 passenger cars valued at $6,202,843 and 7242 trucks valued at $3,713,978. Exchange restrictions, however, have hampered further development of the market.

William L. Batt Gets Gantt Award

William Loren Batt, deputy director, of the Office of Production Management's production division and president of SKF Industries, Inc., has been awarded the Henry Laurance Gantt Memorial Medal for "distinguished and liberal-minded leadership in the art, science and philosophy of industrial management in both private and public affairs." The presentation was made by the Gantt Medal Board of Award which is composed of representatives from both The American Society of Mechanical Engineers and the Institute of Management.

Victor Lee Emerson

Victor Lee Emerson, who did some pioneer work in connection with aircraft engines and automobiles, died in Philadelphia, on May 6, at the age of 77. He is credited with having built experimental aircraft engines in Alexandria, Va., in the early years of aviation and to have held nearly 100 patents, some of them relating to automobile parts.

Truck Production by Capacity

(U. S. and Canada)

	FIRST THREE MONTHS		
	Units		Per Cent of Total
	1941	1940	1941
1½ Tons and less	271,543	196,989	85.78
2 to 3 Tons	32,041	14,332	10.13
3½ Tons and over	5,017	3,087	1.58
Special and buses	2,706	1,500	.85
Station Wagons	5,235	5,083	1.66
Total	316,542	220,991	100.00

Estimated Dealer Stocks of New Passenger Cars

1941	January	February	March	April	May	June
Production—U. S. Domestic Market †	401,799	385,676	398,882	.....	.....	.....
Retail Sales—U. S. ‡	303,564	345,551	449,597	.....	.....	.....
Change in Inventory	+98,235	+40,155	−50,715	.....	.....	.....
Inventory, First of Month	336,550	434,785	474,940	424,225	.....	.....
Inventory, First of Month, 1940	215,856	325,102	412,800	416,281	414,672	399,592

†—U. S. Census Bureau. ‡—Automobile Manufacturers Association.

New Anti-Glare Screen Developed by Polaroid

Edwin H. Land, president of the Polaroid Corp., Cambridge, Mass., has patented a new type of glare eliminating screen for sun glasses, lamps, windshields, etc. The new Polaroid is wholly synthetic and is said to be the first of its kind not dependent upon imports.

A new synthetic rubber-like plastic known as palyuinyl alcohol which has been exposed to an iodine solution replaces the quinine crystals formerly used. The plastic is stretched from four to eight times its normal length, causing the molecules to all become parallel to each other. The result is a filter which lines up light waves so that they all vibrate in the same direction.

Harry Tipper

Harry Tipper, who was business manager of AUTOMOTIVE INDUSTRIES from 1917 to 1925, died at Lafayette, Ind., on May 7, aged 61. Mr. Tipper was born in Kendal, England, and received an engineering education. He came to this country in 1897 and found his first employment on the Hudson and Manhattan tunnels, where he helped to install the electric power system. In 1906 he turned to sales work and two years later he created the advertising and sales promotion department of the Texas Co., which he managed until 1917. After leaving AUTOMOTIVE INDUSTRIES Mr. Tipper joined the General Motors Export Co., where he was in charge of export advertising. In 1934 he became executive vice president of the American Manufacturers Export Association, and in 1939 he purchased *Overseas Trader*, an export publication, in New York.

While business manager of AUTOMOTIVE INDUSTRIES Mr. Tipper contributed to this publication numerous articles on sales promotion and labor problems. He was the author of a number of books, including "New Challenge of Distribution," "The New Business," "Human Factors in Industry," and "Discussion on Labor." He was widely known in advertising circles and was the founder and first president of the Advertising Club of New York.

ADVERTISING

Guy C. Smith, of Brooke, Smith, French & Dorrance, Inc., was elected chairman of the board of the American Association of Advertising Agencies at the annual convention in Hot Springs, Va., last month.

Meldrum & Fewsmith, Cleveland agency, has been appointed to handle product advertising of Republic Steel Corp., also of Cleveland. The new assignment is in addition to the national campaigns which the agency has handled for Republic during the past 11 years.

Kenneth B. Butler & Associates, Mendota, Ill., is now handling the advertising and sales promotion activities of the De Kalb Wagon Co., De Kalb, Ill., manufacturers of small commercial bodies.

CENSORED

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, M. W. Bourdon.

The annual report of the Vauxhall Motor Co. (General Motors British subsidiary, normally producing Vauxhall cars and Bedford buses and trucks) shows a small decline in net profits from £499,-111 in 1939 to £477,578 in 1940, despite 1939 including the first few months of the war, when no profit was earned, while 1940 was commenced with organization completed for war work at high pressure. The difference can be accounted for by heavier taxation. General Motors, as holders of the ordinary shares, again receives a dividend of 15 per cent, absorbing £112,500. Appropriation for the employes' profit-sharing scheme is £37,472; £1,582,627 is carried forward, against £1,283,235 brought forward from 1939.

* * *

In a recent speech the Minister of Transport said that co-ordination is necessary and it is one of his duties to see that every form of transport pulls together in the war effort. He admitted that new arterial roads are urgently needed in various parts of Britain, but said that there would be neither labor nor other facilities available to build them during the war.

* * *

To ease the shortage of new parts for replacements, every distributor and dealer normally handling Wolseley cars has provided the makers, at their request, with a list of Wolseley parts in stock available to repairers whose requirements cannot be met at the factory. The Wolseley Co. acts only as intermediary.

* * *

The scarcity of new and reconditioned tires for civilian vehicles is increasing and almost every tire depot has a long waiting-list. Operators of trucks and buses are being advised to anticipate their tire needs at least six months in advance and systematically to order a few tires each month in excess of estimated requirements, so as to build up a small reserve.

* * *

The Financial Secretary of the Treasury expressed surprise in Parliament in reporting that at the end of last year there were 77,000 more private cars in use in Britain than at the end of 1939, and that during the year ended March 31 there was an increase of £4,000,000 in the revenue from motor taxation.

Timken Adds Giant Electric Furnace

The largest round electric furnace and the second largest in the world, this steel producing giant of Timken Roller Bearing Co., at Canton, Ohio, poured 80 tons on its first heat recently. Its rated capacity is 65 tons. Timken's electric furnace output is stepped up to 360,000 tons yearly.

PUBLICATIONS

Jessop Steel's 8-page booklet describes its "New Process" **Cold Header Die Steel,** a non-porous steel developed especially to meet the severe service conditions encountered when cold-heading bolts, screws, rivets, etc.*

A new twelve-page catalog on **hydraulic power saws** by Peerless Machine Co., contains many action pictures of its sawing machines and metal-cutting data of special help to those having defense contracts for heavy armament.*

A new folder (No. 1882) covering Link-Belt's line of **welded steel base plates for adjusting pillow blocks and common flat boxes** for shaft alignment, is announced by the company.*

Bulletin No. 10, **American Rod Straightener and Shear Machines,** has been released by The American Foundry Equipment Co. It gives construction and mechanical details of Models F, E, D and H.*

Bulletin HD-441, Hevi Duty Electric Co. describes in detail and gives specifications for its **Box Type Furnace.***

The April issue of **The Mainspring,** Wallace Barnes publication, contains an informative article entitled "The Problem of Deflection."*

General Electric Bulletin 3539 tells about **its heating cable.** This flexible, lead-covered cable can be bent and formed readily to fit almost any low-temperature heating job involving temperatures up to 165 degrees F.*

New literature by Westinghouse Elec. & Mfg. Co. as follows: Booklet describing **SL transformers, transformer tanks, core construction and auxiliary parts;** Bulletin on **ignition spot welding timers** to control welding of aluminum, heat treated alloys and other materials; Revised edition of the "Quick Selector" catalog; Bulletin on A-C and D-C **ammeters and voltmeters** for general use.*

Mahr Mfg. Division of Diamond Iron Works, Inc., has issued new bulletins on its car bottom annealing furnaces describing and illustrating its **Tool Furnace** and **Annealing Furnace,** giving detailed specifications and dimensions on both.*

Catalog 2A by Engineering Sales Co. describes and illustrates **equipment for the drafting room.***

Niagara Power Squaring Shears are illustrated and described in Bulletin 72-B, by Niagara Machine & Tool Works. Included also is a Capacity Chart for its various gaging equipment.*

Marschke Heavy Duty Grinders and Buffers are described and illustrated in a new catalog by Vonnegut Moulder Corp. Included, also, are tables giving specifications of each model.*

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* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Monthly Motor Vehicle Production

(U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1941	1940	1941	1940	1941	1940
January	423,248	375,476	100,878	74,016	524,126	449,492
February	405,130	350,535	104,103	71,690	509,233	422,225
March	422,351	364,947	111,561	75,285	533,912	440,232
Total for Year	.....	3,802,454	.....	889,884	.....	4,692,338

Book Review

OXYGEN BOOSTING FOR DIESEL ENGINES FOR TAKE-OFF, *by P. H. Schweitzer and E. R. Klinge. Bulletin No. 54 of the Pennsylvania State College Experiment Station, State College, Pa.*

This bulletin contains an account of the work done at the Experiment Station to determine the possibilities of boosting the output of Diesel-type aircraft engines by supplying them with oxygen during take-off. By raising the oxygen concentration of the intake air from the normal 21 per cent to 45 per cent, the b.hp. of the test engine was increased from 2.90 to 4.65, the maximum cylinder pressure from 700 to 780 lb. per sq. in., the specific fuel consumption from 0.43 to 0.59 lb. per i.hp.-hr. and the exhaust temperature from 620 to 1000 deg. Fahr. The maximum rate of pressure rise decreased from 88 to 60 lb. per sq. in. per deg. and the ignition lag from 9.5 to 5 deg. The bulletin describes the test equipment and test procedure, and gives the results obtained.

SAE Summer Meeting At White Sulphur, June 1

Consideration of alternates for priority-tagged materials, and discussions of the latest developments in aircraft engines, diesel engines, fuels and lubricants, and motor vehicle engineering headline the program of the summer meeting of the Society of Automotive Engineers to be held at the Greenbrier, White Sulphur Springs, W. Va.

The tentative line-up of subjects and speakers appears on early editions of the program as follows:

June 1: Banquet—A. T. Coldwell, SAE President, Toastmaster.

June 2: "Design Features and Performance Characteristics of Daimler-Benz 601A Aircraft Engine" — Raymond W. Young, Wright Aeronautical Corp. (Various parts of the engine will be on exhibition.) "Load Distribution Factors"—F. B. Lautzenhiser, International Harvester Co. "Design Elements Affecting Safety" — J. Willard Lord, Atlantic Refining Co.

June 3: "Light Airplane Engines and Their Fuel Problems"—C. T. Doman, Aircooled Motors Corp. "Combustion Gas Turbine Design"—Dr. J. T. Rettaliata, Alis-Chalmers Mfg. Co. "Procurement and Testing of Military Motor Vehicles"—Capt. Jean E. Engler, Quartermaster Corps, U. S. Army. "Recent Tank Engineering Developments and Problems" — Brig. Gen. G. M. Barnes, Ordnance Department, U. S. Army.

June 4: "Aluminum Alloy Applications for Major Diesel Engine Parts"—P. B. Jackson, Aluminum Co. of America. "Fundamentals of Welding Applied to Steel Crankcases"—Everett Chapman, Lukens Steel Co. "Is it Practical to Streamline for Fuel Economy?"—James C. Zeder, Chrysler Corp.

June 4: "Engineering for Better Fuel Economy"—H. T. Youngren, Olds Motor Works. "The Rolling Resistance of Pneumatic Tires as a Factor in Car Economy" —W. F. Billingsley, B. F. Goodrich Co.; R. D. Evans, Goodyear Tire & Rubber Co.; W. H. Hulswit, U. S. Rubber Co., and E. A. Roberts, Firestone Tire & Rubber Co. "Petroleum and the War"—Dr. R. E. Wilson, Office of Production Management, Petroleum Unit; and Pan American Petroleum and Transport Co.

June 5: "Problems and Possibilities of Mechanical Supercharging of Diesel Engines"—H. L. Knudsen, Cummins Engine Co. "American Experiences with the Buchi Turbo-Charging System" — J. P. Stewart, Elliott Co.; Ralph Boyer, Cooper-Bessemer Corp., and John W. Anderson, American Locomotive Co. "A Rational Basis for Correlating Data on Compression-Ignition Engine Performance at Different Intake and Exhaust Conditions"—Martin A. Elliott, Explosives Division, Bureau of Mines. "Mechanical Minds for Motor Cars" —Harold E. Churchill, Studebaker Corp. "Designing for Alternate Materials" — Thomas A. Bissell, Technical Editor, SAE Journal. "Evaluation of Diesel Fuels in Full Scale Engines:" Report of Cooperative Fuel Research Committee — Presented by Walter G. Ainsley, Sinclair Refining Co. "Review of Temperatures"—Road Test Engines—B. E. Sibley, Continental Oil Co. "The Motor Car Rides with Plastic"—G. W. Walker, Industrial Designer, Detroit. Film: "The Magic of Modern Plastics" (Courtesy of Modern Plastics Magazine).

June 6: 1940 Road Detonation Tests—R. J. Greenshields, Shell Oil Co.; J. M. Campbell, General Motors Research Div., and W. M. Holaday, Socony-Vacuum Oil Co. "The Significance of the 1940 CFR Centralized Road Test Technique to the Engine Builder" —W. E. Drinkard, Chrysler Corp. "The Ignition System as Influenced by Fuel Characteristics"—J. T. Fitzsimmons, Delco-Remy Div., General Motors Corp. "A Proposed Method for Duplicating Road Octane on the Multi-Cylinder Engines in the Laboratory"—J. A. Moller, Pure Oil Co.

Thickol Plant at Midland

To meet the constantly spiraling need for Thickol synthetic rubber, the Thickol Corp. and the Dow Chemical Co. have opened a new plant at Midland, Mich., which increases Thickol production at Midland to 330,000 lb. a month, and brings one step closer the projected U. S. total for all Thickol plants operating or contemplated of 6,000,000 lb. per year.

Lindberg Doubles Capacity

Lindberg Engineering Co., Chicago, has opened a new $250,000 plant which doubles its manufacturing capacity of heat-treating equipment. The plant is designed for straight line production on most types of furnaces.

Details of the Messerschmitt

(*Continued from page* 532)

A complete installation of flight and engine instruments are to be seen, including a German version of our well-known Sperry artificial horizon. An interesting remote indicating compass is provided, actuated by a big compass placed well aft in the fuselage and electrically connected to indicators in the pilot's and radio operator's cockpits.

Armament

All of the offensive armament is concentrated in the nose, with none being provided in the wings. The four fixed machine guns, of about .30 caliber, are closely fitted into the upper section of the fuselage nose, with ammunition boxes occupying the lower portion of the nose. Two 20 mm. cannon receivers being directly beneath the radio operator's cockpit in convenient position for loading. Compressed air charging and electric solenoid firing control is provided for guns and cannon.

A gun-sight mount equipped with transverse and vertical adjustment is fitted to the upper center of the pilot's instrument panel, but the sight itself was not received with the airplane. The single flexible machine gun is mounted in such a crude manner that one is forced to the conclusion that this gun is an afterthought. An Arado universal mount is bolted to a support plate bolted to a fuselage frame, and provides for locking the entire mount in vertical, or in positions about 30 degrees each side of vertical, and then tilting or swiveling the gun in its yoke support.

A quick-detachable, electrically operated bomb rack is fitted to the lower central portion of the fuselage and provides for carrying two 550-lb bombs. Release and aiming are electrically controlled.

Power Plant Installation

The power plants are 1150 hp. Daimler-Benz DB 601, liquid-cooled, 12-cylinder, geared, V-type, inverted, gasoline-burning engines, having a displacement of approximately 2069 cu. in., and able to develop their maximum horsepower to about 20,000 ft. through the use of a multi-speed, hydraulically controlled supercharger. Take-off rating is said to be 1360 hp. Each engine weighs approximately 1600 lbs. Like all German airplane engines, these substitute direct injection of the fuel for carburetors, and Bosch fuel injectors are mounted between the cylinder banks, spraying fuel into the cylinders at a point directly opposite the spark plugs, which are in pairs along the outside of the cylinder banks. Fuel of 87 octane or better is used.

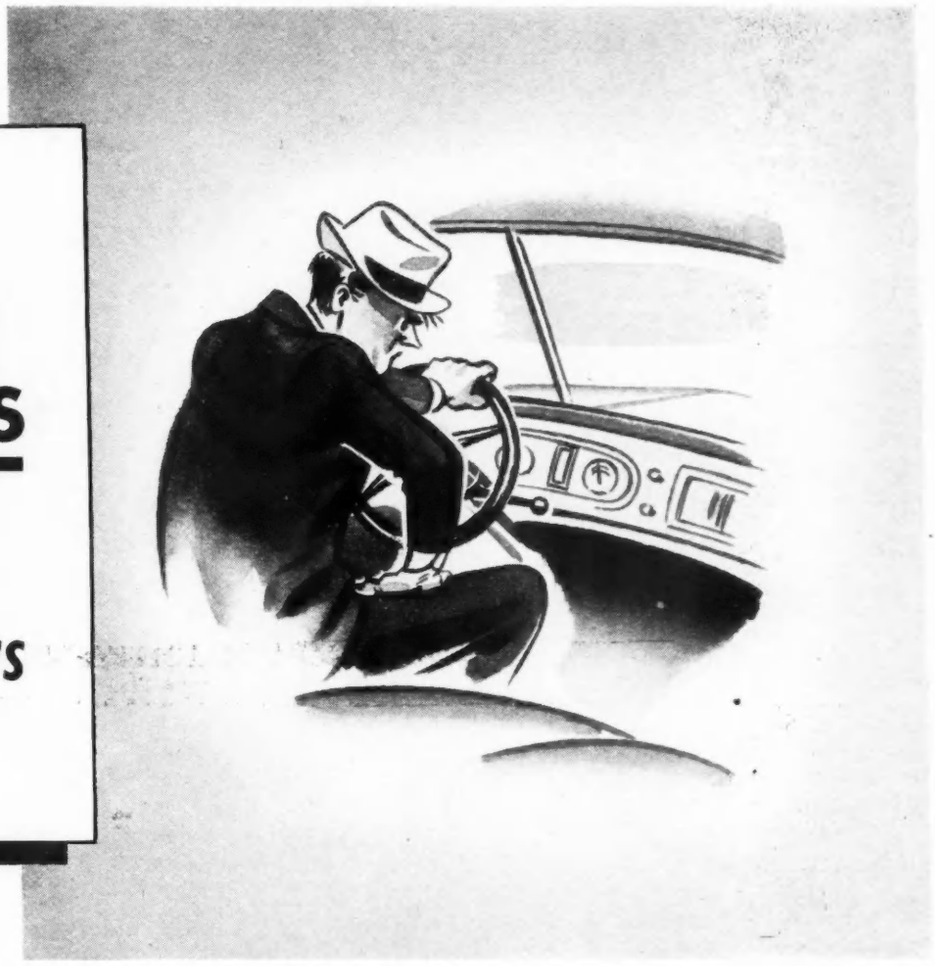
Each engine drives a three-blade propeller — electric - controllable, constant speed, German-built VDM—about 11 ft. diameter. An automatic electric timing device prevents the engine being operated at take-off power for more than a few minutes, and a propeller governor is provided.

The long, narrow coolant radiator for each engine is mounted beneath the wing at a point outboard of the engine nacelle, and just forward of the wing flap. The radiators extend upwards for the depth of the wing, a construction made possible by the absence of a rear spar, and are provided with a controllable air exit shutter. A mixture of 50 per cent water and 50 per cent Prestone is used as the coolant.

A rather small oil cooler is mounted beneath each engine, and connected to a leak-resistant oil tank of approximately 11.5 capacity. The fuel to oil ratio of approximately 21 to 1, indicates that the Daimler-Benz engines have a low oil consumption.

A careful detailed study of this airplane will soon be made under the personal supervision of Mr. Richard W. Palmer, vice-president in charge of engineering at the Vultee plant, Los Angeles.

It's the LITTLE THINGS THAT GET INTO THE CAR OWNER'S HAIR



The power plant and the running gear of the modern automobile are remarkably well engineered for long, trouble-free operation. But the car owner is not, and should not be, satisfied with that alone. He has the right to expect the same high degree of performance from car accessories as he receives from the engine, chassis and running gear.

When these accessories fail to render the same quality of performance, the car owner becomes increasingly irritated and, consequently, dissatisfied with his purchase. He begins to wonder whether he made a wise choice.

You can prevent instrument board gauges from being listed among such irritations when you standardize on King-Seeley Electric Telegages.

King-Seeley Telegages are engineered to operate accurately and without attention for the life of the car.

One of the tests King-Seeley Electric Telegages are put to is the vibration test. No King-Seeley construction is adopted which cannot withstand an accelerated breakdown vibration test for a minimum of eight continuous hours. In this test the vibrator has exceptionally high amplitude, and the r.p.m.'s are continuously varying from 0 to 6000.

Eliminate possible criticism of the instrument board gauges in your car by standardizing on King-Seeley Electric Telegages.

KING-SEELEY TELEGAGES
SHOW FUEL LEVEL, OIL PRESSURE AND WATER TEMPERATURE
Transmission is entirely by Wire—No Tubes

KS TELEGAGE

KING-SEELEY CORPORATION
ANN ARBOR MICHIGAN
SUPPLIERS OF ORIGINAL AUTOMOTIVE EQUIPMENT SINCE 1922

OTHER PRODUCTS
INSTRUMENT PANELS • SPEEDOMETERS • GOVERNORS

MEN and MACHINES

(*Continued from page* 529)

Trabon multi-outlet pumps for this system are available in three sizes having different reservoir capacities. They are driven with a worm gear, available in various ratios for use with chain, gear, belt or direct motor connection. The pumps have one, two or three outlets. The system also is designed to permit manual lubrication with a hand gun.

ROCKFORD DRILLING MACHINE DIVISION of the Borg-Warner Corp., Rockford, Ill., has placed on the market a toggle-type over-center clutch, designated the Rockford LMC Clutch, which is intended for use with gasoline and other motors up to 6 hp. on spray equipment, tool grinders, pumping equipment and other small machines. The maximum outside diameter of this clutch is 4½ in. Its principal features are described as follows:

A—Strong symmetrical body is accurately machined, as is steel shifter-spool. Operating links, pins, and rollers are all hardened steel. Toggle action goes "over-center," locks clutch in driving position. B—Clutch plates are steel, hardened and ground. High-grade specially selected facing material is securely fastened in place. C—No oiling necessary for metal bushing which carries driven sprocket, pulley, sheave, flange, or other part of machine in which clutch is installed. D—Steel end-plate is threaded for fine adjustment; has fibre protecting plug, slotted locking screw.

A RECENT development in the materials handling field is the pneumatic roller for carriers on belt conveyors wherever the shocks of impact are excessive. It is introduced by the Stephens-Adamson Mfg. Co., Aurora, Ill. These pneumatic carriers are designed for use under loading spouts and in belt feeders where the impact of heavy bulk loads subject both conveyor belt and carrier to abnormal strains and wear.

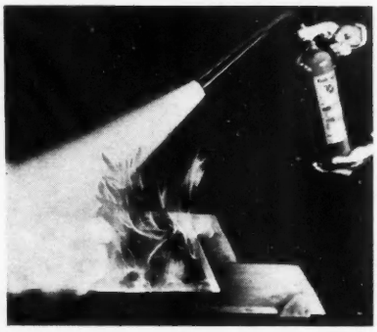
The carrier, mounted on a steel hub in which bearings and shaft are housed, consists of a series of pneumatic rubber units, 6 in. in diameter with thick, wear resisting treads. The rollers are inflated and permanently sealed.

THE NATIONAL emergency has finally produced an extinguishing agent that puts out magnesium fires in industry and in incendiary bombs. This new substance, known as Pyrene G-1 Fire Extinguishing Powder, is the result of combined research by the Dow Chemical Co., Midland, Mich., and the Pyrene Mfg. Co., Newark, N. J.

In addition to incendiary bombs, the use of magnesium alloys has skyrocketed in aircraft and other defense production. Protection against metallic fires, therefore, is a national necessity. Usual extinguishing methods, however, do not work. Makeshift substances such as talc, soapstone and sand are unsatisfactory. Water or any substance containing moisture increases the speed of combustion, sometimes with explosive violence.

The new product, Pyrene G-1 Fire Extinguishing Powder, is a dry inert compound that stops the combustion of magnesium as well as other metals such as sodium, potassium, aluminum and zinc. It also contains a material which, when heated, forms a heavy, air-excluding, fire-smothering vapor. The powder is applied to the fire by spreading it with a scoop or shovel. Being non-abrasive, it may be used freely around machinery.

FOR speedier fire fighting operation, a trigger control valve is incorporated in the 4-lb. carbon extinguisher announced by Walter Kidde & Co., of Bloomfield, N. J. It is named the Kidde-Lux Model No. 4. This type of discharge control not only permits the extinguisher to go into action faster, but also insures no wasting of the carbon dioxide gas while the operator is maneuvering around the blaze. The



Kidde carbon dioxide fire extinguisher, 4-lb. capacity, with trigger control.

nozzle arm is equipped with a swivel so that the discharge horn is held in a "down" position when the extinguisher is not in use. For operation, the horn is aimed at the fire. Specifications of the new unit follow:

Carbon dioxide capacity..	4 lb.
Underwriters' Laboratories rating	B-2; C-2
Average charged weight.	17 lb.
Average height, valve and cylinder	17½ in.
Hose diameter	⅛ in. pipe
Hose length	6 in.
Cylinder diameter	4½ in.

NO. 11 POLYMATIC is the new model of wire forming and cut-off machine being manufactured by the Unit Machinery Co., Rockford, Ill. It is readily adapted to cutoff work parts as found in carburetors, locks and other precision products. The spindle is mounted rigidly on roller and ball bearings with a helical drive gear between them. Control levers are conveniently grouped, cams are simply changed and the proper timing of the automatic action quickly set. The tool slide may be equipped for any one operation, such as drilling, knurling or box turning. The length of this high speed screw machine is 50 in., its width 18 in. and its height 46 in. It requires a motor of 2 to 3 hp.

GLOVES made of Resistoflex PVA, a transparent rubber-like material that is unaffected by almost all organic solvents, have been developed by the Resistoflex Corp., Belleville, N. J. They are intended as protection against occupational diseases and toxicity due to handling of chemicals. In metal working industries they are effective in protecting the hands and arms of machine operators exposed to sulphur-base cutting oils. Since they contain no sulphur and hence will not tarnish metal surfaces, they are useful to inspectors in handling metal parts having finely polished surfaces. Available sizes are 8, 9, 10, and 11, the three smallest sizes being produced in 10½-in. and 14-in. lengths while size 11 is made in 10½-in., 14-in. and 18-in. lengths.

STEELWELD MACHINERY DIVISION of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, is now equipping some of the larger Steelweld Bending Presses with individual overhead traveling cranes to permit one operator to handle heavy cumbersome plate in and out of a machine as well as to support it during press operations.

The cranes are fabricated by the Cleveland Tramrail Division of the company and are mounted on top of the machines with crane runways extending approximately 8 ft. in front. The crane bridge and carrier are hand propelled. The hoist is motor-driven and controlled by means of a pendant push-button station. The hoist is 2-ton capacity.

HOWELL ELECTRIC MOTORS CO., Howell, Mich., announces the addition of a new line of open-type electric motors with complete protection against dripping liquids, metal chips and other falling particles. An extra large fan is incorporated to assure efficient ventilation.

What the Industy is Doing

(*Continued from page* 519)

inaugurated a six-day schedule beginning late in April to make up for almost three weeks' output lost due to the recent strike at the Rouge plant.

Production for the week ending May 10 was estimated at 132,500 units, approximately the same as the previous week and the highest week's total since May, 1937. The week ending May 17 was expected to maintain about the same volume of output. GM divisions produced 54,700 units in the week end-

Aviation Form-A-Gasket for automobile cylinder head assemblies. A liquid that is applied with a brush and changes in a few seconds to a paste.

Does not dry ... does not run ... heatproof.

Prevents loss of compression, water seepage, corrosion and head seizure.

Permatex Company, Inc., Sheepshead Bay, N. Y., U. S. A.

ing May 10, while Chrysler accounted for 27,600 vehicles. Ford, operating on a 6-day week at the Rouge plant for the first time since 1925, produced 33,000 units. Studebaker headed the independents, followed by Nash, Hudson, Packard and Willys.

Ford, GM and Chrysler all plan to operate well into July on 1941 models to supply the current demand. Despite the high rate of production, U. S. dealer stocks of new passenger cars showed a contraseasonal decline in March, dropping 11 per cent to 424,195 vehicles on April 1. This was only 2 per cent higher than a year previously, while retail sales for the first three months of 1941 have soared 35 per cent. New passenger car registrations from 86 principal cities for the first 14 days of April showed a 30 per cent gain over the same period of 1940.

Automotive Materials

(*Continued from page* 525)

now necessary with this type of plastic. Each cam cut from a formed blank is said to have the strength needed to withstand all but very heavy feeds, and also retains its efficiency even when in contact with heat, oil, and moisture.

Frederick Post Co. Offers VAPOpaper for Trial Test

OWNERS and users of white print dry developer or ammonia vapor machines are cooperating with Frederick Post Co., Chicago manufacturer of sensitized papers, in final tests on the new VAPOpaper. Among its features are: 50 per cent rag content bond, two "speeds" in censitivity, regular and fast; and two colors, deep royal blue and "Post" red. The Frederick Post Co. claims that its new sensitizing medium prints out to a cleaner, whiter background and at the same time leaves all lines in deeply colored contrast. To owners of ammonia vapor machines, who care to cooperate in the "field trial" test under "on the job" conditions, stock of VAPOpaper will be sent for only a brief report on its performance in return.

Ampco Renames Aluminum Bronze Welding Material

THE coated aluminum bronze welding rod produced by Ampco Metal, Inc., Milwaukee, has been re-named Ampco-Trode. Among its outstanding features are: Hardness up to 375 Brinell, great tensile and compressive strength, and its ability to be used by all welding methods (metallic arc, carbon arc, and oxy-acetylene). It is also characterized by excellent resistance to wear, corrosion and fatigue.

Ampco-Trode is used for overlaying forming and drawing dies, building up broken gear teeth, refacing wearing surfaces, repairing broken parts, and welding steel, cast iron, Ampco Metal, bronze, and similar metals.

Nonscratch Lubricant for Cartridge Cases

A NEW lubricant called No. 1025 Nonscratch has been placed on the market by Wayne Chemical Products Co., Detroit, for use especially in connection with the drawing of copper alloy cartridge cases, which must have a perfectly smooth finish. Starting from a rather thick disk, a cup is made and then by drawing and redrawing, a casing is completed, the last draw usually entailing the greatest change in its shape and wall thickness. To lubricate these difficult draws the parts are dipped into a solution and washed immediately after each operation on the press to remove any particles that might cause a scratch in the next draw. In making a lubricating solution for this purpose, the Wayne product is diluted with five times as much water.

Corroflex Packing is New Sherman Product

REFLECTING the growing importance of waterproof packing, the Sherman Paper Products Corp., of Newton Upper Falls, Mass., announces the addition of a waterproof Corroflex to its line of cushion packing materials. Corroflex is the flexible corrugated packing material with criss-cross indentations that combines a protective corrugated cushion with an outer covering of Kraft.

Through the addition of the duplex sheet with asphalt lining, still greater strength plus waterproof qualities have been added to this packaging material for greater resistance against puncturing, abrasion and breakage.

Corroflex will be available in a special, all-purpose weight in rolls from 6 to 72 in. and in sheets cut to size.

The Werner-Gren Aeronautical Laboratory

(*Continued from page* 517)

forced-concrete construction being used. All steel beams are wall-bearing, to avoid telegraphing of sound. All rooms, moreover, are acoustically treated with tile and rock wool.

To protect the test personnel from noise, heat and obnoxious gases, all test equipment is operated by remote control, and the control room is hermetically sealed. Specially-designed soundproof doors and observation windows are incorporated in these control rooms. Control rooms are air-conditioned, and the air pressure in them is raised above that of the test rooms, so that no exhaust gases can filter in.

As very large engines are to be tested in the laboratory, use is made of the newly-developed induction type of electric dynamometer in combination with the conventional d.c. dynamometer. The induction dynamometer has a solid-steel armature which is grooved at its periphery and which revolves inside a water-cooled stator. A stationary coil produces a flux of magnetism through both the rotor and stator. When the rotor is being rotated, eddy currents are induced in the stator, and the heat produced by these eddy currents is carried away by the cooling water. The heat thus carried away is equal to the energy absorbed by the dynamometer, and the torque is measured in the same way as with the regular electric dynamometer, by means of a weighing scale. By varying the excitation, any amount of power may be absorbed, within the limits of the capacity of the machine.

The inductor-type dynamometer cannot drive or "motor" the engine, for starting or for friction horsepower tests, hence it is usually combined with a d.c. electric dynamometer of sufficient capacity for these functions.

Following is a list of the major items of equipment found in the Werner-Gren laboratory:

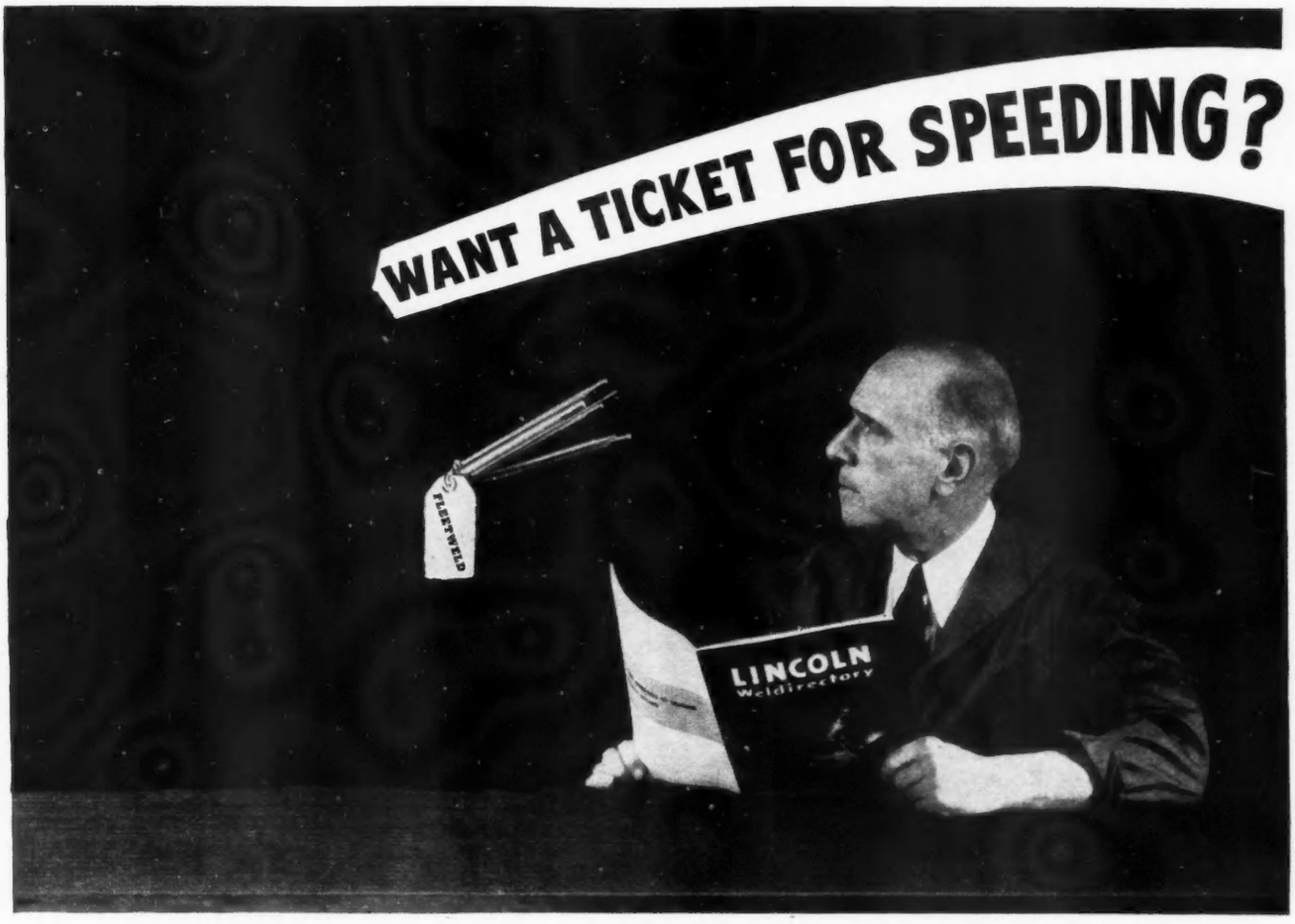
Room No. 8—*Power Room* equipped with: 1 G.E. motor generator. Motor—250 hp., 4150 volt, 3 phase, 60 cycle. Generator—175 kw., 250 volt, D.C. 1 Transformer—75 kw., 4150 volt to 208 volt, 3 phase, 110 volt, single phase. 1 Excitor—15 kw., 208 volt, 3 phase motor, 250 volt D.C. generator. 6 Panels for switch gear and starting equipment.

Room No. 9—*Dynamometer Room* equipped with: 1 G.E. electric dynamometer—150 hp., 2000-5000 r.p.m. Howe Weightograph Scale. 1 Cooling air blower—3500 c.f.m., 10 in. Sp., 10 hp. D.C. motor. 1 Floating engine bed. 1 Trolley beam and 1 ton hoist. 3 Resistor units. 1 Automatic air compressor—150 p.s.i.

Room No. 10—*Dynamometer Room* equipped with: 1 G.E. Combination dynamometer. 300 hp. Electric 1000-2000 r.p.m. 1200 hp. Induction 1000-3000 r.p.m. Howe Weightograph Scale. 1 Cooling air blower—40,000 c.f.m., 16 in. Sp., 200 hp. D.C. motor. 1 Floating engine bed. 1 Trolley beam and 1 ton hoist. 4 Resistor units. 1 Automatic air compressor—150 p.s.i.

Rooms Nos. 13, 14 and 15—*Dynamometer Rooms*, each equipped with: 1 G.E. Inductor dynamometer. Provided with 5 hp., 400 r.p.m. built-in starting motor. Howe Weightograph Scale. 1 Cooling air blower—3500 c.f.m., 10 in. Sp., 10 hp. D.C. motor. 1 Floating engine bed. 1 Trolley beam and 1 ton hoist. 1 Automatic air compressor—150 p.s.i.

Room No. 11—*Propeller Test Room*, 12 x 12 x 54 ft. equipped with: 1 Rigid engine test stand. 1 2-ton hydraulic lift.



ALTER EGO: Literally "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

ALTER EGO: Certainly the Whizz Electrode demonstrator showed you speed *almost* as good as with "Fleetweld."

But the speed really was good, and the weld looks OK.

ALTER EGO: Yes, but, most of all, the *demonstrator* was good. How about the *conditions* of the show?

Come to think about it—it was just a show.

ALTER EGO: Right. 'Twas the work of a good, biased demonstrator. What counts are the results of our own men—the SPEED and QUALITY *they* can attain and maintain under *production* conditions—hour after hour—day in and day out.

Well, isn't "Fleetweld" just the ticket for that? What are we waiting for?

* *

LINCOLN SUGGESTS: Study of welding production methods often increases speeds as much as 50% through the use of work positioning, revised technique or better types of electrodes. The "Procedure Handbook" ($1.50 postpaid) on page 210 contains valuable information on this subject. Or perhaps the Lincoln man nearby can be of service to you. No obligation, of course.

LINCOLN "SHIELD-ARC" WELDING THE LINCOLN ELECTRIC COMPANY Cleveland, Ohio

Authoritative Information on Design • Production • Welding Equipment

Lead Base Alloy Die Castings

(*Continued from page* 521)

tests on plated lead die castings indicate long life of the plated deposit for outdoor service. In this connection the plating on lead die castings will be found superior to that on zinc die castings. This primarily is due to the high corrosion resistance of lead and the electronegative role lead plays when coupled with other metals. If the lead base metal should be exposed to the atmosphere as a result of voids in the plate or by any other means, there will not be readily formed a corrosion product through the plate such as is found on electroplated deposits of other metals.

In electroplating lead alloys, it is essential to consider two factors which have to do with the quality of the finish. These concern the polishing and the method of cleaning the casting prior to plating.

Because of their relative softness, lead alloys are subject to plastic flow in polishing and care should be taken not to use too high a peripheral speed and to apply as little pressure as possible. The normally smooth surfaces obtained on die casting are such as to require little or no polishing—a simple buffing operation only being necessary to bring out sufficient luster.

The luster need not be high, since in subsequent cleaning operations, the surface becomes etched and the original luster dulled.

The cleaning of lead die castings prior to plating is extremely important. To avoid blistering of the plate, it is necessary to obtain a surface which is absolutely clean and free from films of any kind. This is difficult because of the insolubility of most lead compounds which may be formed during the cleaning operations. Cleaners which contain soaps are very apt to leave on the surface of the lead casting insoluble lead soaps which are not readily removed. A 6 oz. per gallon trisodium phosphate solution used cathodically is recommended as a cleaner followed by a dip in sodium hydroxide solution of up to 10 per cent in concentration.

An acid dip following the alkaline cleaning is necessary to neutralize alkali left on the casting. The selection of the right acid and its concentration is very important.

Meyer & Helmle,[1] in an excellent paper based on years of study, recommended the following procedure for the successful electroplating of lead-antimony alloys.

I. Direct Nickel Plates—nickel under 0.0003 in.

1. Solvent or vapor phase clean.
2. Electroclean as cathode—1 to 3 mins. at 30-50 amp. per sq. ft.—trisodium phosphate solution 4 to 6 oz. per gal.
3. Reverse clean as anode—15 secs. at 30-50 amperes per sq. ft. in 4 oz. per gal. sodium carbonate solution.
4. Dip in sodium hydroxide solution 2 to 4 oz. sodium hydroxide per gal.
5. Dip in 20 per cent solution hydrochloric acid.
6. Nickel plate warm solution 100 deg. Fahr.
7. Chromium plate.

II. When it is desired to deposit a heavier plate than 0.0003 in., it is recommended that a substantial copper coating (minimum 0.0003 in.) be first applied direct on the lead base alloy to be followed by nickel and chromium. Meyer & Helmle point out that heavier deposits of nickel than 0.0003 in. give rise to cracking of the nickel plate, which is due to a combination of high expansivity of the lead alloy and the relatively high strength of nickel deposit compared to lead alloy.

The recommended sequence of operations in copper plating is as follows:

Proceed as in direct nickel plating up and through No. 5.

6. Dip in 3 per cent solution sodium cyanide.
7. Cyanide copper plate.
8. Nickel plate.
9. Chrome plate.

(*Turn to page* 550, *please*)

[1] Meyer & Helmle—Electroplating on Lead—Antimony Alloy A.E.S. Monthly Rev.—March, 1936.

High stresses and severe weight limitations make material specifications for airplane structural parts and fittings exceedingly strict — which explains the wide use of Chromium-Molybdenum (SAE X4130) steel.

This steel has an excellent strength-weight ratio and good fatigue strength. It is weldable by any process and welded parts can be used without subsequent heat treatment if necessary.

Write for our free publication, "Molybdenum in Steel" for complete technical information.

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Lead base alloys are capable of being finished in a wide variety of organic finishes for decoration.

In applying such finishes, however, consideration must be given to the relatively low melting temperature of these alloys and the effect that elevated temperatures may have on their properties.

The high baking materials cannot readily be used but only air-drying or low temperature baking (below 200 deg. Fahr.) can be recommended. There are now on the market a number of satisfactory materials which can be air-dried or the air drying forced with low temperature baking or with infra-red lamps, which will give almost the same good service as the high baking materials.

The following procedure is recommended:

1. Sand Blast.
2. Apply air drying or low baking primer
3. Apply finishing coats.

In place of sand blasting, which serves both to clean the surface and roughen it, the casting may be dipped in a strong caustic soda solution (10 per cent), which will clean and slightly etch the surface to enhance the adhesion of the paint.

Today's Cemented Carbide Tools

(*Continued from page* 527)

designed tool holders and simple gages which make it possible to effect the major settings in the tool room, leaving only the final adjustment to be done on the machine.

Perhaps the best way to show the effectiveness and economy of the steel cutting tool materials is to quote some of the case studies that have been contributed by various sources.

Carboloy reports that machining has replaced grinding to a large extent in the fabrication of rams and liners of 500 to 550 Brinell hardness for extruding aluminum, copper, and brass. Ajax Steel and Forge has found that machining time could be cut in half by turning the heat treated forgings with Carboloy. Cutting speed is around 35 f.p.m., with an average depth of cut of 1/16 in.

While the economies in mass production are obviously on a high plane of achievement, Carboloy has demonstrated some remarkable performance figures in machine tool plants where job-lot production is the rule. For example, the Monarch Machine Tool Co., found that it could double or even triple production by the use of cemented-carbides, could handle a correspondingly heavier schedule without increasing plant capacity or investing in additional equipment.

At Gisholt, the selection of a group of ten standard Carboloy tools took care of the machining of about 80 per cent of the jobs passing through the shop, stepped up production about 30 per cent.

At Warner & Swasey, one of the busiest machine tool plants in the country, 2500 small-lot jobs were tooled with Carboloy, effecting an average improvement of 43 per cent in machining time.

Vascoloy-Ramet submits the following case studies on steel cutting operations:

Flywheel ring gear of S.A.E. 1050, heat treated to a Brinell hardness of 460. The operation is turning the O.D. and the straddle-facing on a 12-in. Fay automatic. With Vascoloy - Ramet Grade E, the work is done at 298 f.p.m., with a feed of 0.019 in. per rev., depth of cut 1/16 in., floor-to-floor time 0.8 min., with 345 pieces per grind.

An automatic clutch hub of S.A.E. 1045 with a hardness of 200-225 Brinell is turned and straddle-faced on a Fay automatic with the following performance:

	Vascoloy Ramet Grade "E"	High Speed Steel
Speed	245 to420 S.F.M.	80 S.F.M. max.
Feed	0.023 in.	0.023 in.
Depth	3/64 in.	3/64 in
Pieces per hour	250	50
Pieces per grind	2,000	120

An example of the performance of Kennametal steel cutting tools is the 300 per cent improvement in facing the bolt pads and shaping the inside pads, with interrupted cuts, on a chromium-nickel steel planetary gear carrier. The facing of bolt pads is done on a W & S turret lathe using Kennametal modified style 12 Grade KM tools with a soluble oil coolant. Cutting is done at a speed of 168 to 121 f.p.m., with a feed of 0.015 in. and depth of cut ranging from ⅛ to ¼ in. The tool was good for 32 pieces, touched up twice with a hone, slightly worn at the end of the run. Previous experience with h-s-s tools was a maximum of three pieces per grind at a speed of 66 f.p.m.

Another example is the boring of airplane struts made of S.A.E. 4150 heat treated forgings with a hardness of 402 Brinell. This job was tooled on a Bullard V-T-L with Kennametal grade KH tools. Although h-s-s tools failed on this job, the Kennametal tools handled it in roughing at 125 f.p.m., finishing at 150 f.p.m., with a feed of 0.014 per revolution. Depth of cut was 1/16 in. for roughing, 0.010 in. for finishing.

Haynes-Stellite tools with their exceptional high red hardness and good edge strength also contribute materially to the machining of steel parts at high speed. A plant making ring gears of forged S.A.E. 4615 steel uses Haynes-Stellite "2400" metal-cutting tools to undercut the I.D. of the gears. The operation is performed on a Bullard Mult-Au-Matic machine at 83 surface f.p.m., using a feed of 0.036 in. per rev. and a 3/16-in. depth of cut. A soluble oil coolant is used and an average of 410 pieces per grind is obtained. After the undercutting, the gears are rough-bored in this same machine at 83 surface f.p.m., using a feed of 0.032 in. per rev., and a ⅛-in. depth of cut. In this operation an average of 267 pieces per grind is obtained with the Haynes Stellite alloy tools as compared with an average of 68 pieces per grind with the steel tools previously used.

The back of ring gears for trucks are rough-faced with Haynes Stellite Star J-metal tools at another plant. The gears are made from S.A.E. 4615 drop-forged steel having a Brinell hardness of 143-163. The facing operation is performed with a Bullard Mult-Au-Matic machine at 49 r.p.m. The surface speed is 161 f.p.m., with a feed of 0.021 in. per rev. and a depth of cut of ⅛ in. A compound coolant is used and an average of 65 pieces per grind are machined.

One automotive plant rough-turns drive shafts of rolled S.A.E. 1020 steel using Haynes Stellite "2400" metal-cutting tools. The turning is done at 176 surface f.p.m. with a feed of 0.032 in. per rev. and a depth of cut of 3/32 in. A soluble oil coolant is used. Practically all steel-turning jobs at this plant are tooled with Haynes-Stellite "2400" tools.

Finally, it is important to note the recent comment by James R. Longwell that old machine tools are no bar to the application of hard tool materials for steel cutting operations. He points out that there is no reason why machines such as turret lathes and boring mills, provided they are in good operating condition, cannot be readily adapted to the use of carbide tooling. In cutting steel with carbides the objective is to make the speed high enough to prevent the formation of the built-up edge. This means that the cutting speed should be around 200 f.p.m.

The older machines must be carefully checked to assure adequate power. Provision must be made for handling the increased chip production, aided by the installation of chip breakers where the size of openings requires small chips.

Army's Air Freight Service

(*Continued from page* 510)

and must move to the West Coast. So, upon landing at Patterson Field, the air freight terminal makes the necessary load change and the transport proceeds westward, following its original schedule for the remainder of the trip.

Aircraft Structures

Laminated with Plastics

(*Continued from page* 514)

respects than in ordinary plastic molding, partly because, when a rubber bag or blanket is used (as described in the earlier article) it conforms readily to the required shape. Also, very little flow of the plastic is required and, as the laminations are laid in the mold in the shape and position required, the wood is not required to flow as it would have to do if used in the form of wood flour filler—as in ordinary grades of phenolic plastic—in a conventional mold with both parts positive. Since with the rubber blanket or bag the pressure against the material being shaped is always normal to the surface, no "draw" is involved, and there are no such limitations as those imposed by depth of draw in ordinary molding.

Adequate resistance to deterioration in service from moisture adsorption, weathering and other items seems to have been established by many tests. It has long been known that if a proper job of laminating is done with phenolic resins, delamination will not occur, even in boiling water, which is a severe test. Haut reports on tests in which samples laminated with phenolic resin were subjected successively to a cycle of 8 hours of boiling in water, 8 hours in cold water, and 8 hours of drying, for a total of 200 hr. Thereafter the samples were broken manually and "showed no evidence of joint failure." He also submitted a 4-ft. panel of typical wing structure to a day's immersion in boiling water followed by baking to set up violent shrinkage stresses. Examination thereafter showed that the bonds successfully resisted the stress imposed, whereas other samples with other adhesives (not of the plastic type) disintegrated after a few hours of immersion. The test wing panel, shown in an accompanying photo, was cut from its mooring after a year of exposure on the roof of a building, and is in good condition, whereas—Haut reports—duplicate panels with other adhesives "had long since collapsed."

According to Forest-Products-Laboratory tests mentioned by Haut, joints made with casein and other animal glues fail by hydrolysis, a decomposition through attack by micro-organisms, and by stresses in the wood itself, but the phenolic resins are said to be completely immune to such attack and to chemical hydrolysis.

In shear tests reported by Haut, samples bonded with phenolic resin and baked for hours at 140 deg. Fahr., showed a much stronger joint than similar ones bonded with casein, set in clamps over night and then aged at room temperature for ten days. In many cases the strength was twice as great with the casein, and even more.

Clark reports that samples of Duramold having ratios of edge area to total area thousands of times as great as the ratio in airplane shells show an increase in weight of less than 1 per cent after seven weeks of complete immersion, with negligible change in dimension, no deformation and no change in physical characteristics. Repeated cycles of exposure, first at 140 deg. Fahr. and then at —70 deg. Fahr., resulted, says Clark, in no deleterious change.

Other data as to the effect of service conditions on structures of the type here discussed (plywood bonded with phenolic resin, in particular) could be given, but the author has seen none to indicate that failures or significant deterioration occur as a result of moisture, weathering, rapid change in temperature or attack by micro-organisms or insects. It is possible, of course, that they might occur if laminations are unduly thick or if the resin is not supplied

in sufficient quantity to impregnate the wood adequately. Methods of avoiding such failure would appear to be feasible if not obvious. Naturally, the methods by which plywood shells are attached or bonded to other elements of the structure will have an important effect upon the strength of the assembly, but there appear to be many ways in which suitable joints of this nature can be made to meet requirements.

That plastic bonded plywood structures resist certain types of distortion better than metal structures of equal weight follows from data given by Clark and mentioned in earlier paragraphs. This is especially true in fuselage shells, wing coverings and other "skin" surfaces subjected to buckling stresses. It requires no demonstration to show that a thin sheet of metal is easily buckled, whereas a sheet of plastic-bonded plywood of the same weight (which is much thicker), resists buckling much better. It follows that the plywoods requires fewer stiffening members. It is known, of course, that thin metal skin in aircraft structures does not retain precisely the contour desired in flight, but is subject to distortions which sometimes result in an undulating surface far from ideal from the standpoint of minimum drag. Partly for this reason, apparently, and partly because of the numerous rivet heads which protrude from metal surfaces and result in somewhat turbulent air flow, plastic-bonded plywood planes tested in flight are reported to require as much as 25 per cent less power to maintain a given speed. There may be also a further benefit from the remarkably smooth surface which is easily produced on plywood, a degree of smoothness which, even though it be duplicated on metal, has not an equal effect because the metal distorts more and requires rivets not needed in the plywood structure.

Phenolic plastics used for bonding are, at worst, slow burning. They do not readily support combustion and they tend to impart this property to wood impregnated by them. Doubtless the degree of fire resistance varies with the proportion of resin present, but it is known that a flame capable of raising the temperature of the plywood sufficiently, results in progressive charring rather than in a ready ignition. A flame hot enough to burn a hole in Duralumin has less rapid and noticeable effect on resin-bonded plywood, although the latter will be charred. In any case, resin-bonded plywood should not be classed as readily flammable.

Phenolic plastics in molded form are not subject to corrosion and are not attacked by or soluble in lubricants or in fuel such as is used in aircraft. A plywood surface not completely impregnated with the resin might absorb small amounts of fuel or lubricant, but the usual finish, which is based on the same resin, would prevent this and leave no ground for criticism on this score.

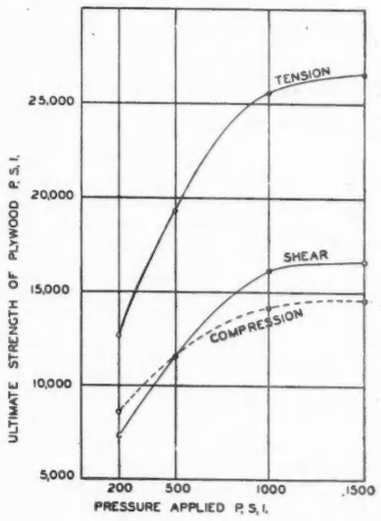
Both wood and the resins used for bonding it are poor conductors of heat and this is presumed to be favorable from the standpoint of reducing the chances of ice formation on exposed surfaces, whereas the icing of similar metal surfaces is sometimes a serious hazard. Although the author has no specific data tending to support the foregoing presumption, the claim of non-icing characteristics has been made by Clark and others, and there appears to be little doubt of its validity.

It is often said that both wood and plastics have less tendency to transmit vibration (and hence a greater tendency to "absorb" vibration) than metal does. The same may be said as to resonance in the two classes of materials, and there seems to be little doubt that combinations of wood and plastics in aircraft structures result in better absorption of vibration and in less resonance than occurs in similar metal structures. Strictly quantitative evidence in support of this conclusion has not been offered, as far as the author is aware,* yet it is generally considered justifiable. In any event, benefits of a similar nature account in part for the use of laminated phenolic gears and pinions in automobile engines and their use certainly results in quieter operation than with metal gears.

The foregoing is a brief summary of the facts and presumptions which tend to support the several advantages claimed for plastic-bonded plywood structures and listed early in this article. It is quite proper, however, to consider them as largely academic or merely potential unless and until they are demonstrated in practical applications. Several such applications have been made, and test results reported tend definitely to support the practicality of planes constructed largely, though not wholly, of plastic-bonded plywood. Although many details are lacking, reports of tests indicate that the advantages referred to can be realized in practical flight. A Fairchild Model 46 five-place plane having a plastic-bonded plywood fuselage (made by the earlier Duramold process) and wings covered with plastic-bonded plywood, was flown in August, 1937, gained Civil Aeronautic Authority approval (No. 2-545) and was reported still in active service about the middle of 1940. A plane of which a large part was produced by the Vidal process and which was equipped with a 75-hp. engine attained a top speed of 137 m.p.h. as against 112 m.p.h. for a (presumably equivalent) commercial, fabric-covered plane equipped with the same engine.

At least one plane constructed by the Timm process is reported to have undergone successful flight tests, but data regarding performance are lacking. Bellanca is understood to have built two or more plastic-bonded plywood planes and to have subjected them to tests, with results satisfactory to Government authorities, but again details are lacking.

Since the foregoing was written, further information tending to support the conclusions made has become available, although some of it is lacking in definiteness because of Government or other restrictions. It is reported, for example, that a 42-ft. fuselage for a bombing plane of Canadian Avro Anson design has been built by the Vidal Research Corp. and has undergone successfully static tests. The fuselage is said to be "10 to 15 per cent" lighter than conventional models of metal and fabric and capable of sustaining heavier loads. Plans for its production in quantity in Canada, for training purposes, are reported in progress if, indeed, production is not already under way. A Vidal licensee in Bristol, Va., is said to be starting work on "more than one thousand bombing plane noses," presumably for production by the Vidal process, to fill a Canadian order.



Curves showing relation between the ultimate strength of plywood made from 1/48-in. birch veneer bonded with Tego film and specific pressure applied in effecting the bond, as reported by Perry before I.A.S.

In a recent paper by Thomas D. Perry, Development Engineer of the Resinous Products and Chemical Co., before the Institute of Aeronautical Sciences, it is pointed out that some of the earlier difficulties with plywood resulted from the use of gummed tape to hold veneers together, edge to edge, the paper having a tendency to delaminate. Today there is available edge

gluing equipment using resin adhesives and capable of making joints at the rate of 100 ft. a minute. These joints are said to be as strong as the veneer. The equipment is coming into quite general use and cures the resin before the veneer leaves the machine, giving a joint which it is difficult to see.

Tests with birch plywood reported by Mr. Perry indicate that there is a rapid increase in compressive, tensile and shear strength when plies are decreased in thickness from 1/16 to 1/48 in., using a Tego film (phenolic) binder. It was also found that there is a rapid increase in strength in using 1/48-in. plywood veneers when the pressure used in laminating is increased from 200 psi., the increase being nearly proportional to pressure up to about 1000 psi. and then flattening off as the pressure is further increased, as indicated by the accompanying curves. Density also increases, but not so rapidly as the strength. Tego film was used but similar results are reported in using liquid phenolic resin, with which the wood is impregnated. Impregnation results in a material resembling plastic reinforced by wood with a closer approach to the physical characteristics of the plastic, whereas the use of film give a substance with wood characteristics predominating but strengthened by the resin, the report indicates.

It is not clear to what extent these findings will affect aircraft plastic-bonded plywood structures which are molded to shape, inasmuch as the pressures which were employed in the experiments are much above those which appear to be feasible in molding by the use of rubber blankets or bags, but the findings may well have a pronounced effect upon parts such as ribs if the latter be cut from flat sheet laminated in presses.

One report indicates that the O.P.M. a few weeks ago sent to various manufacturers a memorandum suggesting that they investigate the possibilities of using plastics in such a way as to conserve supplies of aluminum. There may well be some ways in which such substitutions can be made if the change is made on a scale which does not create a shortage of plastics. Use of plywood bonded with plastic would appear likely to make the plastic go much further for certain purposes than if the plastic were used with other fillers. Should the aircraft industry turn to plastic bonded plywood in place of duralumin on a large scale, this would certainly have a marked effect on total aluminum requirements, but any extensive shift will require time for investigations, as it would be folly to make the change and then discover that it gave unsatisfactory results. It is certainly unwise to rush into any program of substitute materials until there is positive evidence that the substitutes will serve their purpose adequately. On the other hand, it is a mistake to pass up promising possibilities for lack of suitable study when indications are much in favor of their success, especially when as at present, there is a chance that a change may ease stringencies in other much needed materials for defense applications.

Wright Field Wind Tunnel

(*Continued from page* 511)

tunnel, an air exchanger incorporated in front of the fans automatically spills heated air and breathes in cool air from the outside.

The test section of the wind tunnel is contained within a 68-ft.-high reinforced concrete building, 108 ft. long and 62 ft. wide. Here are located all instruments for automatically measuring and recording the model's reactions, together with air pressures, velocities and temperatures, on the central control panel, which is in an air conditioned, sound proof room at one end of the test section, but sealed off from the test chamber.

The tunnel is tubular in shape, varying in diameter from a maximum of 45 ft. to a minimum of 20 ft. at the test chamber. It requires 700 tons of sheet and structural steel.

The Sales Manager Says...

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